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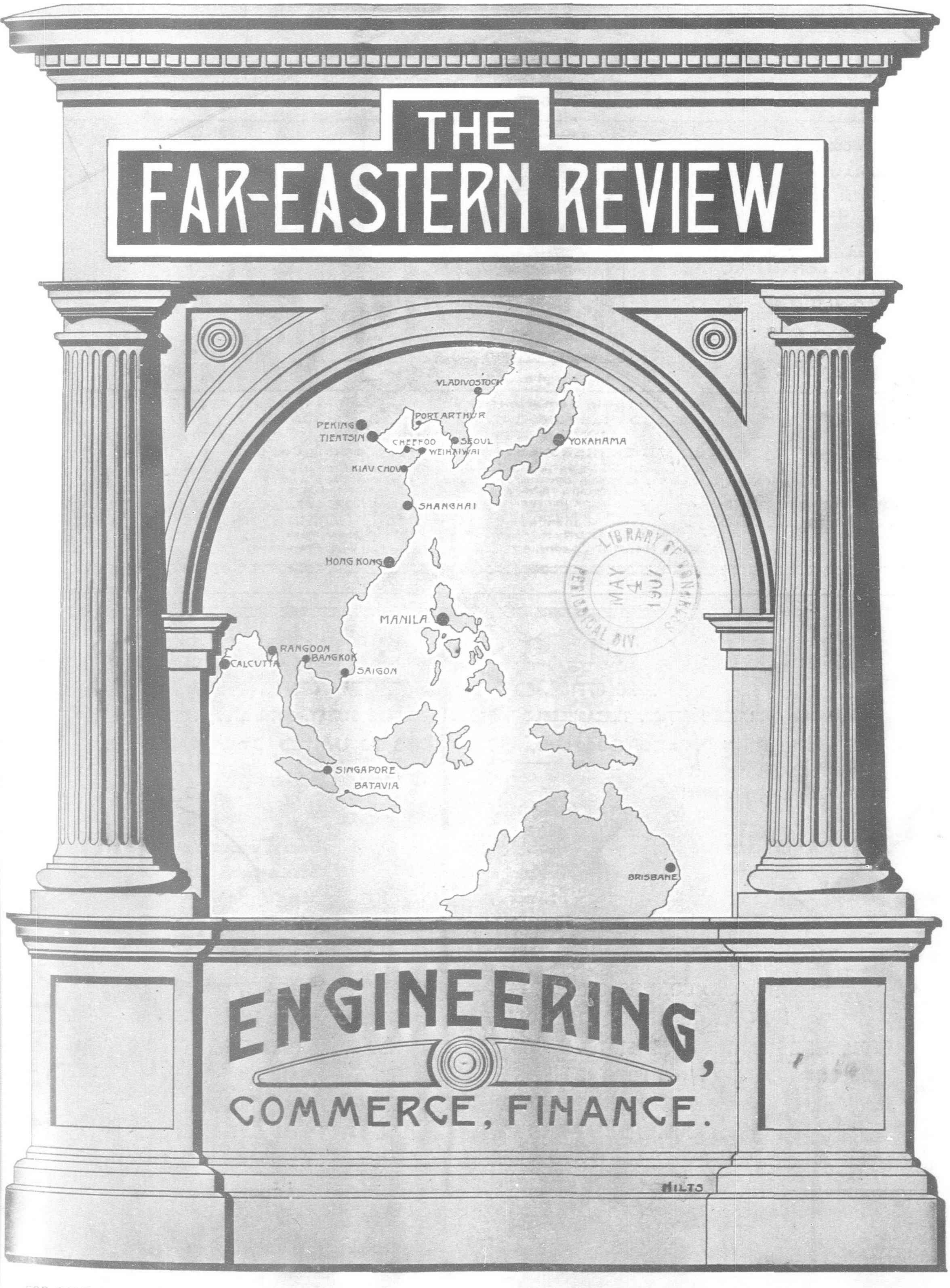

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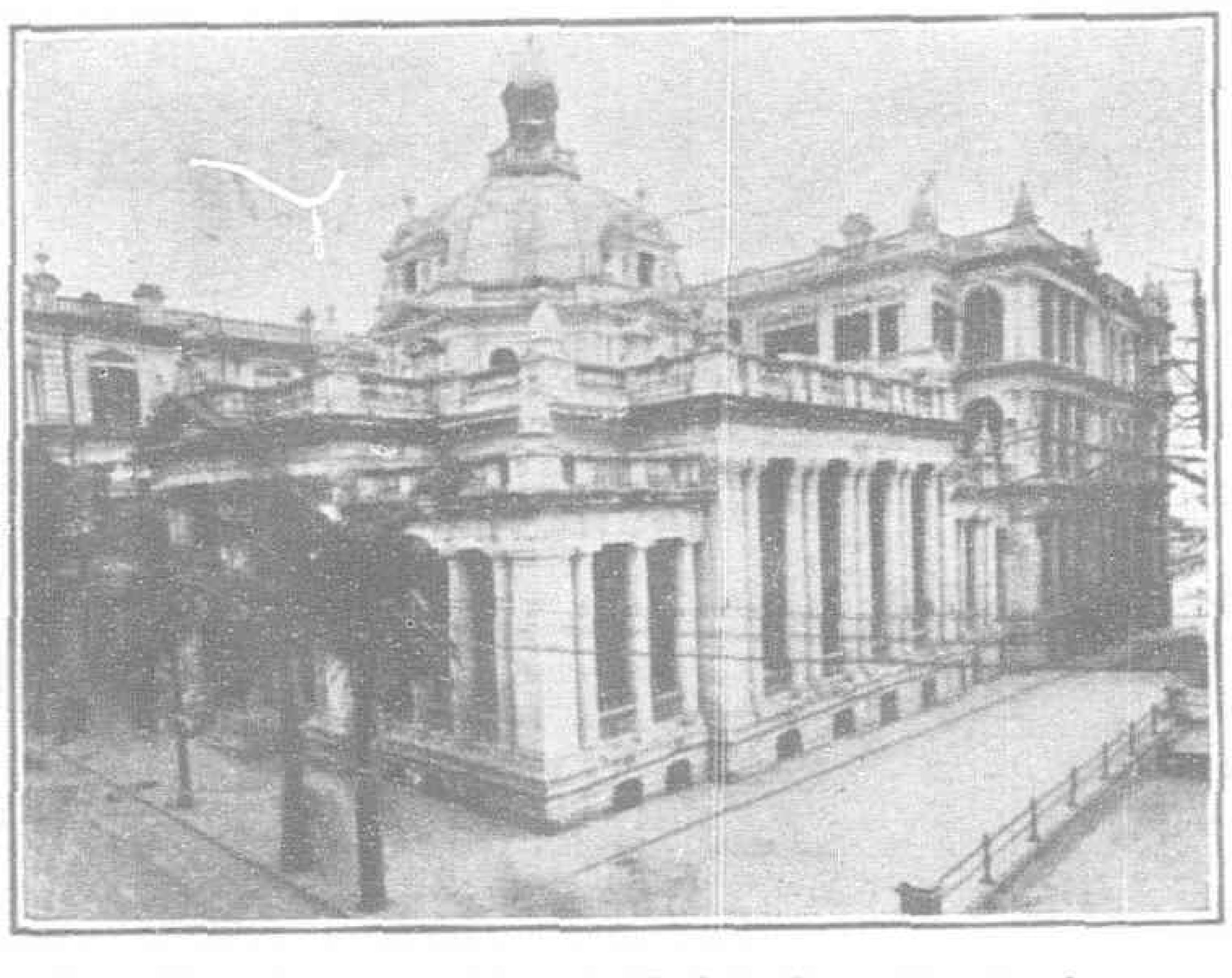

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THE FAR EASTERN REVIEW
COMMERCE ◆ ENGINEERING ◆ FINANCE

VOL. III. MANILA, P. I., SHANGHAI, AND YOKOHAMA, MARCH, 1907. No. 10.

PRACTICAL DESIGN OF ARCHES AND NOTES ON REINFORCED CONCRETE CONSTRUCTION

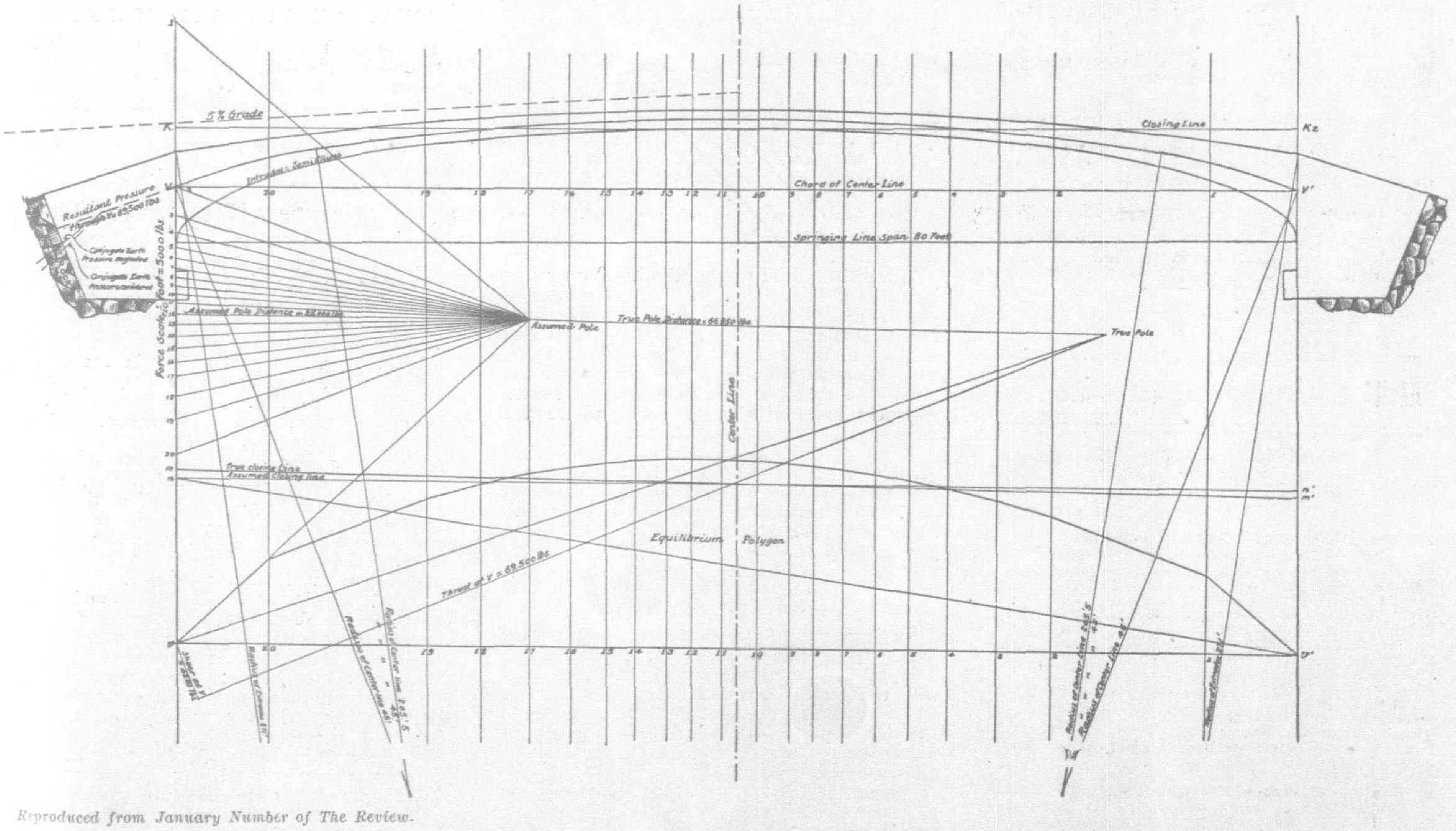
With Special Reference to Tropical Conditions in the Orient

(*By J. C. KOCH, Assistant Engineer, Bureau of Public Works, Manila*)

The principal advantages gained by reinforcing concrete arches with steel are stated as follows in Buel and Hills' *Reinforced Concrete*:—

1. In long spans the thickness of the ring can be made very much less, thus reducing the dead load and effecting a saving of 50 per cent in the cost of the ring.

2. The load being reduced, the thrust is correspondingly less, and the abutments may be made very much smaller.


5% Grade
K
K2
Closing Line
Intrados = Semi Ellipse
V
V'
Chord of Center Line
Springing Line Span 80 Feet
Resultant Pressure through V = 69,500 lbs
Conjugate Earth Pressure Neglected
Conjugate Earth Pressure considered
Force Scale 1 foot = 5000 lbs
Assumed Pole Distance
Assumed Pole
True Pole Distance = 46,850 lbs
True Pole
Center Line
True closing Line
Assumed closing line
n'
m'
Equilibrium Polygon
Thrust at V = 69,500 lbs
Radius of Extrados
Radius of Center line 245'.5
Radius of Center line 45'
Radius of Extrados 21'

Reproduced from January Number of The Review.

GRAPHIC DIAGRAM OF ELASTIC METHOD FOR AN 80′ SPAN; SEMI-ELLIPTICAL INTRADOS AND THREE CENTERED NEUTRAL AXIS

3. Reinforced with steel, the working unit stresses in concrete can be considerably increased with perfect safety.

4. The danger of cracks occurring from any cause can be prevented by the proper distribution of the reinforcing metal.

5. Arch rings of such forms and proportions that the bending moments would render them impossible with any ordinary masonry can be, and have been, constructed of reinforced concrete both easily and successfully.

WATERWAY.—In arch design one of the controlling factors is the amount of waterway to be provided, and for determining this a more or less approximate survey may be made, or the area of the water-shed of the stream may be gotten by scaling a map of the region.

One of the most-used formulas for determining the area is that of Myers':—

$$\text{Area of water-way in sq. ft.} = C\sqrt{\text{drainage area in acres.}} \qquad (10)$$

where C is a variable coefficient depending on the character of ground.

Modified for the Philippines this coefficient may be taken equal to 1.5 for comparatively flat ground or slightly rolling country; for hilly ground 2.25 and for mountainous country as high as 6. These values are $1\frac{1}{2}$ the values used in the United States and should give good results.

Another formula somewhat simpler is Peck's:

$$\text{Area of water-way in sq. ft.} = \frac{\text{Drainage area in acres.}}{C} \qquad (11)$$

In this case C varies from 2.67 to 4 depending on character of topography. These values of C are two-thirds of the values used in the United States and are thought to be adaptable for the Philippines. The smaller value of C being for mountainous country and the larger one for flat country.

SHAPE OF ARCH RING.—The rise and span of the arch being determined from a consideration of the waterway required and the grade of roadway, and possibly other local requirements, the arch-ring may be designed. The writer usually uses an elliptical intrados (or three-centered if necessary), a neutral axis approximating the parabola and a segmental or multi-centered extrados.

DESIGN.—The trial depth of the arch-ring at the crown is taken equal to 0.008 (span plus 10 times the rise), all in feet. The intrados and neutral axis are drawn to scale and the extrados is so drawn that the thickness of the arch-ring at points distant from the crown

(*Continued on page 310.*)

THE FAR EASTERN REVIEW

GEO. BRONSON REA, M. E.
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FUSHUN COAL MINES

Considering the extreme popularity of the South Manchuria Railway shares, attributable to the Fushun coal mines forming part of the company's property, a Japanese paper gives an outline of the scope and scheme of operations of these mines, according to the *North-China Daily News*. To say nothing of the total capacity of the mines, the actual output expected 18 months hence is 3,000 tons per day, which will bring in about -Y-2,000,000 giving a profit of -Y-2 a ton. The working expenses at the start will not exceed -Y-2,000,000. The transportation of 3,000 tons will require 14 trains, one train at present being limited to 38 cars; and as her freight as well as passengers must be provided for, about 20 trains in all may be considered necessary. To facilitate the running of these trains, an obvious necessity is the increase of the number of stations or extension of double tracks, while 2,400 cars and 70 locomotives for the exclusive purpose of coal-carrying will be provided. Some 272 cars and 14 locomotives are to be kept in reserve to be used for one run to and fro every four days.

A depot for the coal will be established in Tairen, which will cost -Y-1,000,000. Of the 3,000 tons daily output half is expected to be consumed by the company and the other half will be exported, so that the coal market of Japan will not be much disturbed. The shipping will be undertaken by five or six colliers for which purpose the employment of the ships captured in the late war is planned.

The 3,000 tons, again, are to be mined from within a narrow region. The existing Chienkinsai pit will have two more borings, one at Yuangpaipao, and another at Laohuai. These will yield respectively 1,500, 900 and 600 tons.

The total initial expenditure for the estimated output as given above is -Y-2,000,000. Of this sum -Y-1,001,027.50 is to be spent on shafts, rails, and other equipment. This outlay will require an annual addition of -Y-100,000 for maintenance. At present, the length of rails needed is 13 miles, and the pit and surface cars will number 2,000, to which 400 will be annually added. For this outlay -Y-28,000 will be required.

The main official personnel will number 125, inclusive of interpreters, and 200 more persons will be employed in a minor capacity. Mechanics and miners will number in all 4,146, of which 667 are to be Japanese, and the rest Chinese. The Japanese will be paid -Y-1.70 and the natives -Y-1 a day. Three hundred and sixty Japanese laborers will be employed at the outset on the same basis of pay.

A rough estimate of the accounts is also given. About -Y-6,109,180 is the expected income from 1,296,000 tons of lump coal and slag. The expenditure will be -Y-2,376,000 for working both qualities, thus giving -Y-3,733,380 on the profit side.

MANILA HEMP MARKET, 1906

Reviewing the London Manila hemp market during 1906, Messrs. Walter H. Hindley & Co., Ltd., in their annual circular say that compared with the fluctuations and vicissitudes through which this fiber has passed in the last few years, the record of the year is a relatively tame and uninteresting one. The effects of the drought and the serious typhoon which in 1905 devastated the hemp plantations in the Philippines appear to have extended over the greater part of 1906, and, in addition to these disasters, the production has been curtailed to some extent by the scarcity and dearness of money, and to some extent by the diversion of labor from the hemp industry to public works, etc. The fact remains that the receipts in the Philippine ports for 1906 show a serious deficit when compared with 1905. Commencing as 1906 did with a high level of prices-ropemakers have turned their attention more than ever to the use of other fibers, and the comparative abundance of these has militated against any serious advance in values. For the first few weeks a fairly good demand prevailed, running chiefly upon the qualities under fair current, but for the next few months there was a period of comparative inertia, varied now and then with some little activity. This continued until June, when the trade, worn out in the expectation of larger supplies and a consequent lower level of prices, came into the market and bought freely, not alone for early delivery, but for shipments extending up to the end of the year, and prices of the ordinary roping kinds then touched about the highest point for the year, common sorts showing a rise since January of £3 to £4 per ton and current and finer grades about £2 per ton. Little of interest happened until August, when unexpectedly heavier receipts in the Philippines brought about some speculative selling, causing values to fall £2 to £3 per ton, but this season exhausted itself, and, the production again falling back to its previous scale, prices tended slowly upwards, and about half of the above fall was recovered. November and December, despite the growing strength of the statistical position, were disappointing months, and until quite towards the end of December values showed a slightly sagging tendency. Fine spinning qualities in 1906, as in 1905, must be treated as almost a separate fiber. Grades such as F E B showed little variation in value during the first six months, being worth £51 to £52 per ton, but during the latter half of the year a steady rise took place, and at the close this grade was quoted at £58 per ton. Some falling off in the production of these qualities was partially responsible for the rise, but the chief reason was the American demand, the bulk of the supplies of finer hemp being attracted to the United States, prices being apparently not much object with the home country when supplies are wanted.

GREAT BRITAIN'S FAR EASTERN TRADE

With regard to the statistics of Great Britain's trade with the Far East during 1906, the most noteworthy feature in the December export figures was the continued shrinkage in cotton piece goods. China's purchases dropped 20,000,000 yds., while shipments to Japan fell as much as 7,600,000 and to Netherlands India nearly 2,000,000. The returns being complete for the 12 months, it will perhaps be more interesting to compare in detail the figures for the year just closed with those of 1905. The cotton yarn and twist trade shows a decrease for China of nearly 3,000,000 lbs., though this is in part balanced by an extra 2,300,000 lbs. for Japan. The Straits supply was also slightly smaller. The trade in cotton piece goods seriously fell off last year, and particularly in the case of China, whose purchases were 150,000,000 yds. smaller in quantity. Dutch East Indies fell 20,000,000 yds., Japan 18,000,000, and the Philippines 6,000,000. The Straits only shows an increase. The linen trade with the Philippines progressed very satisfactorily, almost doubling in volume. In woollen tissues an increase of 1,000,000 yds. is recorded from Japan, and China made a slight advance; while in worsted tissues China increased 3,000,000 yds., and Japan more than 1,000,000. The metal exports, principally to the Straits and Japan, vary considerably, but there does not appear to have been much, if any, all-round increase, and several items show a considerable shrinkage. With regard to imports, the quantity of tea shipped from China again last year showed a large falling off, only 13,000,000 lbs. being imported, as compared with 15,000,000 in 1905. Silk from China also fell 85,000 lbs., while Japan's shipments slightly increased. The Java sugar supply sank to quite inconsiderable proportions, the Straits fell to half the previous year's total, and no sugar was received from the Philippines. The quantity of hemp from the Philippine Islands again fell some 9,000 tons. Tin shipments from the Straits were 2,000 tons larger than in 1905.

BRIDGING THE YALU RIVER

A Japanese authority says that the railway through Korea, from Fusan in the southeast to Wiju on the south bank of the Yalu, is approaching completion throughout its length of approximately 380 miles, and the problem of bridging the river at Wiju so as to carry forward the line to Mukden is once more attracting the attention of Japanese engineers. The present intention is to bridge the stream some little distance below the town of Wiju, and the western end of the structure which it is proposed to erect will be situated at Shin-Wiju, on the west bank, not far from Antung, which, together with Ta-tung-kou, a few miles to the south, was recently opened to the trade of all nations under the treaties made by China with America and with Japan in October, 1903. The place at which it is proposed to provide the bridge is about five miles down stream from that which was the scene of the crossing of General Kuroki's forces on April 30th, 1904, and Shin-Wiju—that is, "New Wiju"—stands just beneath the heights which the Russian batteries occupied to the north of Antung. The length of the bridge, crossing as it will the main channel—the others are all but empty save in the rainy season—is planned to be 3,345′. Embankments will be required on either side, but the engineering difficulties are not expected to be of an extraordinary character, and are by no means insurmountable. Possibly the estimate of about $1,200,000 gold for the entire work will prove to be a sufficiently liberal one. Politically this bridging of the Yalu is not devoid of a certain degree of importance, inasmuch as Japan will be able, if necessary, to send troops as far as Mukden, at all events, without touching the Eastern Chinese Railway, which both Russia and Japan are debarred from using for the purposes of military transport, without violation of the Portsmouth Treaty, and which would constitute an act of war. On the other hand, Japan is bound not to increase her forces in Manchuria beyond a certain limited number, and were she to do so Russia would assuredly, and with justice, lodge a complaint. It is an advantage in every way, and to all, that there will presently be an alternative route to Mukden, however, and progress of this kind is to be welcomed on every side in consideration of the greater facilities that will accrue to the commerce of all nations.

CANTON-HANKOW RAILWAY, A CHINESE PUZZLE

The Hongkong correspondent of the *North-China Daily News* says it is often stated that the path of true love is beset with thorns. It may be affirmed that the building of the Canton-Hankow Railway is beset with both thorns and briars, and, that those who are interested in, and selected for, the furthering of the enterprise, are the very persons who have done much to retard its success. The present situation is characteristically Chinese, and could hardly have been created by less zigzag minds. It is confusion worse confounded. It is difficult for a foreigner, relying only on reports published in the native press, to apprehend clearly and state succinctly the situation. The Chinese mind is needed. The salient points, however, seem to have been something like this:—

When Viceroy Tsên was reigning in the Two Kuang, two Hongkong Chinese gentlemen, who, as shareholders in the railway company, had great influence, and who further had in their possession large sums of money, which Hongkong Chinese had subscribed towards the funds of the enterprise, refused to hand over the money at the central office in Canton when called upon to do so. They demanded first of all a public audit of the accounts already received, and more than insinuated that everything might not be right. As is well known Tsên was removed, and H. E. Chou Fu assumed the reins of power, and, in order that these suspicions might be verified or removed, ordered that the audit be made. It has been carried through, and as far as the public is aware, there appear to be no solid grounds for the suspicions that were aroused. When these two gentlemen declined to hand over the funds, the company naturally resented the action, and so promptly expunged their names from the list of shareholders. After the public audit had more or less testified to the straightforwardness of everything, they wished to have their names reinstated. At this the directors of the company demurred, and indeed refused point blank. But since then another difficulty has arisen, which threatens to be even more disturbing than that mentioned above. At a meeting held in the Kuang Tsai Hospital, Canton, there was a stirring time. A certain Lao Tsz-liang charged the Canton officials with wholesale bribery. It was insinuated that in addition to the Viceroy, Yu, the Provincial Treasurer, Chu, the Provincial Judge, and Taotai Shên had all been guilty of receiving bribes at the hands of the directors of the railway company. The meeting was supposed to be in camera, but somehow a report of the meeting found its way into the pages of *The Political News;* one of the Canton dailies. Of course there was a tremendous outburst of anger, on the part of the officials, whose honesty had been impugned, and a troop of soldiers was at once ordered to the room of the editor who, under safe escort, was compelled to pay a visit to the magistrate's yamên. Here in self-defence he made a clean breast of his part in the transaction, and so the author of the aspersions, Lao Tsz-liang, was arrested, and is now in custody. The officials, it is reported, are furious and consumed by a white-hot rage. They have determined that he shall continue in durance vile until he can produce the very witness who actually saw bribes paid over into the hands of the officials. Further, an attempt has been made to confuse the issue, by insinuating that the secret meeting held in the Kuang Tsai Hospital was sanctioned by the general body of shareholders and directors, whose official representatives in Canton are the Seventy-Two Hongs. The latter have angrily repudiated this sanction. The Seventy-Two Hongs have not only done this, but they have taken vigorous steps to prevent the reinstallation of the two Hongkong Chinese, whose action first of all started the trouble among the shareholders. A few days ago arrangements were made whereby the public proclamation, posted upon the walls of their office, might be photographed just as it was published. The public proclamation denounced the insinuations of the two Hongkong Chinese, and, at the same time, stated in unmistakeable language, that the two agitators should not be reinstated in their old position. All this has been photographed piece by piece, and after the several sections have been arranged, so as to form one complete whole, the proclamation will be forwarded by the imperial post to Peking, for the information of the several boards which are supposed to be interested in the construction of the railway and also have authority vested in them to direct more or less effectively the course of events. Meanwhile ex-Viceroy Tsên has just sent down a long telegram from Shanghai, in which he has advised patience, and deprecates anything like summary and unpremeditated action, either on the part of the officials or the shareholders.

It is easily seen from this brief summary of the reported situation, that affairs have become as inextricably involved, as rings in the hands of a clever conjurer. They can only be separated by the same minds that have produced the confusion. It is often asserted that where there is smoke there must be fire: it is certain that where there is smoke there may be fire, and no one can deny that there is a considerable volume of smoke here. Chan Kang-yu, and his companion Yung, whose action in refusing to hand over the funds led to all that has followed, are by no means without influence among the Chinese in Hongkong and are unlikely to have taken the determined stand without some solid ground for their suspicions and action. At first, when the Viceroy ordered that a public audit be made, some of the directors were reported to be averse thereto and this aversion was animadverted upon in the Chinese press. The more difficult matter to straighten out is the charge of peculation made against the provincial officials *en masse*. Lao Tsz-liang should have had indubitable evidence of such bribery, or he should have kept his mouth closed. He apparently had forgotten that what is spoken in secret in China to-day, as in more favored lands, may to-morrow be proclaimed upon the housetop, and therefore should have been less generous in his insinuations.

Peculation and squeezing amongst Chinese officials are not unknown to the initiated, but the day is dawning when those who are guilty of such shady transactions may read a report thereof and a criticism thereon at their early meal on the following morning. A few years ago when there were no newspapers, such beings were known only to the few, and no one was greatly disturbed, because, probably, all to whom the facts were known, had been, at one time or another, tarred with the same brush. It is not so to-day. What is greatly to be regretted is that the affair should have become entangled into this confusion, when facts call loudly for a straightforward course. When a great enterprise like this is to be put through, confidence in the reliability of the directors should not be undermined; absolute faith in the integrity of the leaders is a *sine qua non* of success. At this juncture when China is making such frantic efforts in so many ways to arrange her affairs so that she may hold up her head among the nations and would regard herself as moving in line with Japan, in the forefront of civilization, an exhibition of this kind, with or without foundation, is much to be deplored, for mud cannot be thrown without either the thrower, or those at whom it is thrown being smirched thereby. Mud-throwing, moreover, is not an occupation that should be indulged in by men whose ambition should be to push forward a great enterprise, but by foolish boys, who are either angry with each other, or captivated by love of a pastime, which is somewhat ignoble.

THE EASTERN MINING COMPANY

It is gratifying to such as have the best interests of the Islands at heart, to see efforts being made toward actual development, and especially so in the field of our rich mineral deposits.

We refer particularly to the establishment of a New York office by A. M. Heise, the President of the Eastern Mining Company and his work in securing the necessary additional capital for the enlargement of its output. The gold-fields of Masbate have passed the days of prospect, and the numerous claims, and several companies actually at work attest the value of the field. Only capital is needed for profitable development, and it is not to be found in Manila.

The Eastern Mining Company received its first impulse and financial support from the slender capital available in Manila and it speaks volumes for the confidence reposed in the enterprise when it is known that the list of stockholders contains the names of many of the most prominent men in the Islands. An amount approximating $100,000, all subscribed for in the Philippines, has been spent in developing the properties, which embrace some 16 quartz claims, all demonstrated, and 30 river placer claims

The Company has had a 5 stamp mill in operation for the last two years and the development now warrants the construction and installation of a larger plant. There is sufficient ore to supply a very large plant so it has been concluded to erect a 40 stamp mill capable of treating 200 tons of ore per day. With the labor cost of 36 cents per day, and food the cost of milling should not exceed $2.00 per ton.

The Company is selling just enough stock to pay for this equipment which will approximate $125,000 and a large proportion has already been placed.

However, it is a long way from Masbate to Manila, and from Manila to Wall Street and with the present boom in Nevada gold mining stocks it is not an easy matter to interest investors.

The Review is not an agent for stock jobbing Companies and will not knowingly commit itself to the indorsement of every scheme originating in the Islands, but knowing as we do of the high character and standing of the prime movers in this concern and from official assays and reports on the mines we have no hesitation in giving the enterprise our cordial support and indorsement.

FOREIGNERS IN CHINA

The foreign population in China in 1906 is estimated by Mr. Thomas Sammons, American Consul-General at Newchwang, at 46,000. This includes 6,454 at Hongkong (British territory), 1,432 at Tsingtao (German), and 7,698 at Newchwang, but does not include the balance of Manchuria and Mongolia By figuring 20,000 to 30,000 Japanese, aside from railway guards, in Southern Manchuria, and as many Russians in the north and Mongolia, the grand total would be over 100,000 foreigners. It is estimated that less than 8,000,000 Chinese are living outside of their native land, 75 per cent of whom are accounted for in Formosa, Siam and the Malay Peninsula.

PRACTICAL DESIGN OF ARCHES AND NOTES ON REINFORCED CONCRETE CONSTRUCTION

(Continued from page 307.)

$\frac{1}{4}$ the entire span is 1.25 crown thickness. Then the principles of the elastic theory are applied. The accuracy of this method of treatment has been demonstrated conclusively in arches of almost every size in reinforced concrete. In fact this method is the only exact means of determining the stresses in an arch-ring of any shape and cross section that is fixed at the haunches. This method is also applicable to hinged arches as well, and to any arch of homogeneous material or homogeneous combination of materials that is continuous throughout the entire span. The method consists in determining the true equilibrium polygon for the given arch and its location in the arch ring.

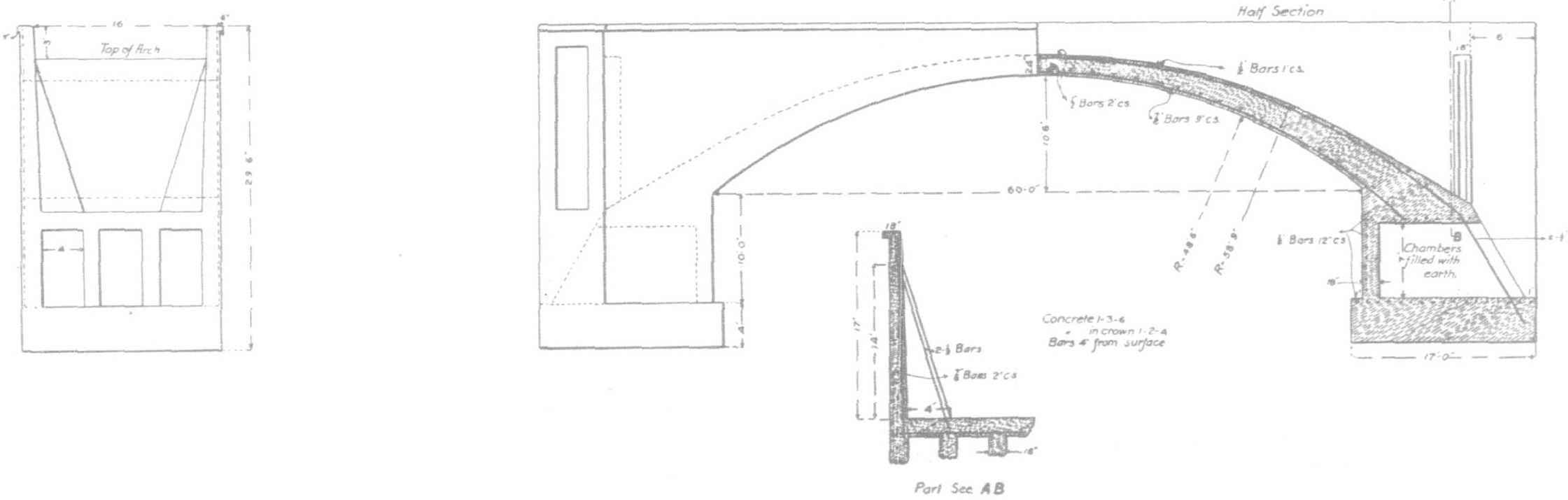
—The following conditions must be fulfilled in a fixed arch for the application of this method: —(1) the tangents to the neutral line at the springing are fixed in direction, (2) the span is fixed; (3) the vertical deflection of one springing with reference to the other is zero.

Mathematically these conditions for an arch of homogeneous material are expressed as follows:—

$$\Sigma \frac{Ms}{EI} = 0$$

$$\Sigma \frac{Mys}{EI} = 0$$

$$\Sigma \frac{Mxs}{EI} = 0$$



STANDARD DESIGN OF REINFORCED CONCRETE ARCH IN THE PHILIPPINE ISLANDS

In the above s is the length of a short segment of the ring measured on the neutral axis, and x and y are the abscissa and ordinate of the center of s with respect to one of the springings of the neutral axis.

In a reinforced concrete arch these equations would take the following form:

$$\Sigma \frac{Ms}{Ec\ Ic + Es\ Is} = 0$$

$$\Sigma \frac{Mys}{Ec\ Ic + Es\ Is} = 0$$

$$\Sigma \frac{Mxs}{Ec\ Ic + Es\ Is} = 0$$

Let T = the horizontal thrust, which is constant throughout the ring for any one series of loads.

" i = the intercept measured vertically between the neutral axis and the line of pressure.

" M = bending moment at any given point.

Then M = T i.

If $s \div (Ec\ Ic + Es\ Is)$ is made a constant by careful subdivision of the arch ring the term $T s \div (Ec\ Ic + Es\ Is)$ may be placed outside the summation sign, giving the simple equations for the elastic arch:—

$$\Sigma i = 0. \qquad (12)$$

$$\Sigma iy = 0. \qquad (13)$$

$$\Sigma ix = 0. \qquad (14)$$

In order to divide the neutral axis into such segments as will make $s \div (Ec\ Ic + Es\ Is)$ a constant, it will be necessary to assume that throughout the entire arch ring the values of $Is \div Ic$ are constant. This involves no appreciable error in the results and simplifies the work. On this assumption $s \div Ic$ is made constant throughout the arch ring. Since Ic varies as the cube of the depth of the section we may satisfy the condition by making $s \div h^3$ a constant.

In this expression s is taken as the length of any segment measured on the neutral axis, and h, the corresponding radial depth of ring at the middle of the segment. When the neutral axis is so divided that $s \div h^3$ is a constant, the simple formulas (12), (13) and (14) may be used.

The ring would theoretically be divided up into an infinite number of segments, s being infinitely small. But in practical graphics it is not possible to deal with infinitesimals, so it is usually divided into 10, 20 or 30 segments. The larger the number of segments the ring is divided into the more exact the location of the equilibrium curve or true pressure line in the arch.

GRAPHICAL TREATMENT.—The graphical method to be given is that of Professor Eddy, with some modifications in analysis based on Church's treatment of the elastic arch.

In *Fig. 4* let vLv′ represent a curve (or equilibrium polygon composed of a series of straight lines) through which we desire to draw a closing line nn′ in such a manner as to have the area above nn′ and included between it and the curve equal to the similar area below nn′. (Let the area above nn′ be considered positive and below it negative.) In other words it is required to draw nn′ in such a manner as to make the area ALB equal to the sum of the areas nAv and n′Bv′. If the intercepts between n′n and vLv′ are i, when these areas are equal, $\Sigma i = 0$. Any number of positions of nn′ will satisfy this condition.

To make $\Sigma ix = 0$. This imposes the further condition that the centre of gravity of the positive area must lie in the same vertical line as the centre of gravity of the negative areas taken together.

No change in the centres of gravity of the positive and negative areas will be produced by adding to each the area vABv′. Suppose this to be done in *Fig. 5*, being indicated by the shaded areas. Then the conditions become (1) the area of the figure vALBv′ must equal the sum of the areas of the two triangles vv′n and v′nn′, and (2) that the centres of gravity of the positive and negative areas must coincide. If we consider the sum of the positive areas as a weight R resting on a horizontal beam, then T and T′ would represent the reactions at the supports of the beam. Divide the curvilinear figure vALBv′ into vertical strips and find the area of this figure. Then compute its centre of gravity. Compute also the centres of gravity of the triangular figures vnv′ and nv′n′ represented by T′ and T, respectively. If the centre of gravity of T and T′ taken together coincides with the centre of gravity of the curvilinear figure the two conditions ($\Sigma i = 0$. $\Sigma ix = 0$) are satisfied, and T: T′: r′f: rf. (A) If these centres of gravity do not coincide the values of vn and v′n′ must be altered until this condition is satisfied. This change may be computed from the evident relation shown in *Fig. 5*,

T:T′:: vn:v′n′ (B)

Also, since the values of T and T′ have to be altered so that the centre of gravity of the two taken together shall coincide with the centre of gravity of R, we have the new relations,

T″: T‴:: vm: v′m′ T″: T‴:: r′f: rf (C)

in which T″ and T‴ represent the new values of T and T′, respectively, and vm and v′m′ the new ordinates to satisfy the condition above stated.

The value of R is always equal to the sum of T and T′. Since the triangles (T and T′) have equal altitudes, equal to the span, the sum of their areas will be a constant if the sum of the end-ordinates vm and v′m′ is equal to the sum of vn and v′n′. From (A), (B) and (C) we derive the relation.

vm : v′m′ :: r′f : rf

When this condition is true equations (12) and (13) are satisfied.

To satisfy the third condition, $\Sigma iy = 0$. In *Fig. 6* let vPv′ represent the neutral axis of any arch, vv′ being the springings of the neutral axis at the abutments. Suppose that v′KK′K″v represents the equilibrium polygon for the loads W′W″W‴. Suppose that the closing line mm′ of the equilibrium polygon satisfies equations (12), (13) and (14). Let all ordinates of the equilibrium polygon and all ordinates of the neutral axis of the arch be measured from mm′ as a reference line, distances above mm′ being positive and below, negative. At any given point in the neutral axis, a, whose coördinates are x, y, let i be the vertical intercept between the neutral axis and the equilibrium polygon. Let i′ = the distance from mm′ to a measured vertically. Also let i″ = the distance (or ordinate) from mm′ to the equilibrium polygon. Then iy = (i′—i″) y. Reference to *Fig. 6* will show that the same relation will apply to all other points of the arch. This being true, $\Sigma iy = \Sigma i'y - \Sigma i''y$. Since Σiy must equal zero for the true equilibrium polygon, Σiy will become zero only when $\Sigma i'y$ is equal to $\Sigma i''y$.

The ordinates of any equilibrium polygon vary inversely as the pole-distance. Hence any change in the pole-distance will produce inverse, but proportional, changes in the lengths of the ordinates of the equilibrium polygon. For this reason, if any pole-distance is assumed for the construction of an equilibrium polygon, and equations (12) and (13) are satisfied, changes in the value of the pole-distance will not affect the values of $\Sigma i = 0$ and $\Sigma ix = 0$

TABLE I.—ADJUSTMENT OF $S \div h^3$.

Point	First Trial				Second Trial				Third Trial				Fourth Trial *				Sum of Distances.
	h	h^3	S	$S \div h^3$	h	h^3	S	$S \div h^2$	h	h^3	S	$S \div h^2$	h	h^3	S	$S \div h^3$	
1	3.50	42.875	7	0.164	3.50	42.875	23.30	0.493	2.10	9.260	12.14	1.368	2.60	17.576	16.10		16.10
2	2.40	13.824	6	0.434	2.40	13.824	6.82	"	1.45	3.048	4.18	"	1.75	5.359	4.90		21.00
3	1.90	6.859	5	0.730	1.90	6.859	3.38	"	1.35	2.460	3.37	"	1.60	4.096	3.75		24.75
4	1.70	4.913	4.5	0.917	1.70	4.913	2.42	"	1.30	2.197	3.08	'	1.48	3.241	2.96		27.71
5	1.45	3.048	4.0	1.32	1.45	3.048	1.52	"	1.30	2.197	3.08	"	1.45	3.049	2.79		30.50
6	1.40	2.744	3.5	1.27	1.40	2.744	1.35	"	1.30	2.197	3.08	"	1.37	2.571	2.35		32.85
7	1.30	2.197	3.25	1.53	1.30	2.197	1.08	"	1.30	2.197	3.08	"	1.35	2.460	2.25		35.10
8	1.30	2.197	3.0	1.37	1.30	2.197	1.08	"	1.30	2.197	3.08	"	1.30	2.197	2.01		37.11
9	1.27	2.048	2.5	1.61	1.27	2.048	1.02	"	1.28	2.097	2.88	"	1.27	2.048	1.87		38.98
10	1.25	1.953	2.0	1.03	1.25	1.953	6.96	"	1.25	1.953	2.68	"	1.25	1.953	1.77		40.75
		82.658	40.75				42.93			29.803	40.75	1.368		44.550	40.75	.915	

*Approximately Correct.

In First Trial "S" is assumed so that $\Sigma s = 40.75$ and the average thickness of each section of ring is scaled off from plan.
In second Trial "h"s remain same as in first Trial and "s" are calculated so that $s \div h^3$ is constant. The h's are always scaled from drawing.

But all the ordinates of the equilibrium polygon will be altered in value inversely as the change in the pole-distance. The position of mm′ is determined, as shown, by making it satisfy the conditions $\Sigma\ i = 0$ and $\Sigma\ ix = 0$. Changes *in the pole-distance do not change the position* of mm′. $\Sigma\ i'y$ can be determined after mm′ has been located, by adding together all the products of each intercept, i′, by its corresponding ordinate, y, of the neutral axis. In a similar manner $\Sigma\ i''y$ is determined. If $\Sigma\ i'y$ is equal to $\Sigma\ i''y$ the value of $\Sigma\ iy$ will be equal to zero, thus satisfying equation (14). If i′y is *not* equal to i″y, the values of i″ must be multiplied by the ratio $\Sigma\ i'y \div \Sigma\ i''y$. This may be done by changing the pole-distance in the *inverse ratio, that is, by multiplying the* assumed pole-distance by $\Sigma\ i''y \div \Sigma\ i'y$. If this is done the new intercepts, i″, will reduce the value of $\Sigma\ iy$ to zero.

This true pole-distance is also equal to the thrust at the crown of the arch and in a direction parallel to mm′.

Thus it is seen that practically the whole problem of the elastic arch is the determination of the closing line of the equilibrium polygon that will satisfy equations (12), (13) and (14).

After the true pole-distance is found the true line of pressure in the arch may be drawn by laying off to scale the values of i at the various points of the arch, measuring from the neutral axis. Positive values of i will be *plotted above the neutral axis and negative* values, below it. The lines joining these points successively is the true line of pressure of the arch.

The pressure in the arch at the various sections will be readily found by drawing the rays of the true equilibrium polygon, and scaling their values directly. At any section, if the line of pressure does not pass through the neutral axis at that section and tangent to the neutral axis of the section, the resultant force will produce a *direct thrust*, a bending-moment and a shear at that section. The bending-moment at any section may be found by multiplying the intercept i by the pole-distance. To find the direct thrust and shear at the given section resolve the resultant force acting at the section into components tangent and perpendicular to the direction of the neutral axis at the given section. The resolved force parallel to the tangent through the neutral axis will be the direct thrust at the section, and the other *component* will be the shear at the section.

To illustrate the graphic treatment an example in arch design will be given as actually worked out by the writer.

EXAMPLE.—Design on arch of 80′ clear span, rise 8′, for a live load of 100 lbs. per square foot, assuming a gravel roadway on top 12″ thick, and spandrel fill of earth below the gravel surface. The grade of roadway is to be 5 per cent on both spandrels. Concrete to be 1 : 2 : 4 and calculated for a *maximum compressive* stress of 400 and maximum tensile stress of 40 lbs. per square inch. The abutments will rest on rock foundation.

The semi-ellipse is first drawn with axes of [illegible] and 80′. Computing crown thickness by the formula given under the head of design, we have crown thickness = 0.008 [80 + 10 (8)] = 1.28′ approximately. Lay off 0.64′ above crown of semi-ellipse and thus locate the crown point of the neutral axis. At the quarter points (*20′ horizontally* each way from the crown point) lay off radially above the intrados distances equal to 1.25 crown thickness. The crown point of the extrados is found by laying 1.28′ off above the crown of the intrados. Through the three points of the extrados thus located pass an arc of a circle, prolonging it to intersection with the verticals through the abutment faces.

The neutral axis is then drawn midway between the intrados and extrados. A 3-centered curve approximating a parabola is usually sufficiently accurate.

The length of the neutral axis is found to be 81.50′. The arch ring is then divided into 20 segments "s" in such a manner as to make $s \div h^3$ *constant for all the segments*. The manner of determining these segments is shown in *Table I*. This is a *cut-and-try* method but usually only a few trials are necessary to properly subdivide the ring. These subdivisions are then laid off on the neutral axis and verticals are passed through these points of division. (These verticals are not shown in the diagram.)

The loads directly over each of the segments are computed from the data given and placed in *Table II*. In order to secure maximum stresses in the arch ring the live load is considered to extend over one-half of the arch. (In most cases this will give maximum stresses, though in special cases there may be a small error in this assumption). A summation of loads is made in *Table II* for the purpose of plotting them on the load line.

Verticals are then drawn through the centers of gravity of the combined loads on each segment. These are numbered from 1 to 20. The weights are all taken for an arch ring one foot wide.

Assuming a pole-distance of 25,000 lbs. and a suitable force scale draw the trial equilibrium polygon *in the usual manner, as shown*.

Draw a line joining V and V′, the springings of the neutral axis.

To make $\Sigma\ i = 0$ is to make the algebraic sum of all the ordinates between the *equilibrium* polygon and the neutral axis equal *to zero*. Distances above the neutral axis are considered positive and below, negative.

The pole-distance being assumed, the trial equilibrium polygon does *not* give the true line of pressure. But after equations 12 and 13 have been satisfied in the trial polygon the exact ratio between the assumed pole-distance and the true pole-distance is readily determined and equation 14 may be satisfied. Now measure the ordinates on verticals 1-20 from V V′ to the neutral axis and place these values in column 2 of *Table III*. In column 3 place the scaled intercepts of the equilibrium polygon included between the closing string v v′ and the upper boundary of the equilibrium polygon. Assuming V′ as the origin, scale the distances to the lines 1-20 and place these values in column 4. These distances are the lever arms of the various ordinates measured on verticals 1-20. These horizontal distances represent the x's of the various points of the neutral axis.

To make $\Sigma i = 0$.

Draw K, K2 at a distance from VV′ equal to the mean of all the ordinates between V′V and the neutral axis. This distance is 84.66 ÷ 20 = 4.233′.

A trial closing line nn′ for the equilibrium polygon is drawn in a similar manner by making vn and v′n′ equal to the mean of the *ordinates of the equilibrium polygon*.

At any point i is equal to the difference between the ordinate of the neutral axis at that point and the corresponding ordinate of the equilibrium polygon. The algebraic sum of all the ordinates of the neutral axis measured from K, K2 is zero. Also the algebraic sum

TABLE II.—LOADS.

Points 1-10 from Rt. Haunch to centre.
Points 20-10 from Lt. Haunch to centre.

Points.	1	2	3	4	5	6	7	8	9	0
Wt. of Ring	7095	1170	616	626	500	480	400	385	375	405
Wt. of Spand	2900	330	235	110	—	—	—	—	—	—
Gravel Surface	1610	490	375	296	279	235	225	201	187	177
Total Loads	11605	1990	1225	1032	779	715	625	586	562	582
Summation	11605	13595	14820	15852	16631	17346	17971	18557	19119	19701
Points.	**20**	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**
Wt. of Ring	7095	1170	615	626	500	480	400	385	375	405
Wt. of Spand	2900	330	235	110	—	—	—	—	—	—
Wt. Gravel Surface	1610	490	375	296	279	235	225	201	187	177
Total Loads	11605	1990	1225	1032	779	715	625	586	562	582
Live Load	1610	490	375	296	279	235	225	201	187	177
Total Loads	13215	2480	1600	1328	1058	950	850	787	749	759
Summation	23776	10561	8081	6481	5153	4095	3145	2295	1508	759

TABLE III.—(Section 1′ wide)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Points	Ordinates Arch	Equilibrium Polygon			Triangles		Ordinates for Closing Line		Products i′y Col 8 × Col 2	Products i″y Col 9 × Col 2	True Ordinates Equilibrium Polygon Co. 8 × $\frac{14.32}{36.70}$	Meas. of Moments Diff. Col. 12 Col. 9	Moments Foot lbs. Col. 13 × 64,000	Thrusts from Drawing.
		Ordinates	Lever Arms	Moments	Ordinates	Moments	mpm′	K′ a K″	Arch	Equil. Poly.				
							(—11.05)	(—4.233)			(—4.37)	(—0.14)	— 8,980	66,500
V′	2.00	5.50	6.60	36.30	0.96	6.27	—5.40	—2.39	—4.78	—10.80	—2.11	+0.28	+17,960	66,000
1	3.60	9.55	17.70	169.00	2.56	45.20	—1.71	—0.37	—1.33	—6.14	—0.67	—0.30	—19,200	65,500
2	3.95	10.60	21.60	228.96	3.25	70.00	—0.71	—0.17	—0.67	—2.80	—0.28	—0.11	— 7,040	65,000
3	4.30	11.38	24.50	278.80	3.54	86.70	+0.05	+0.11	+0.47	+0.22	+0.02	—0.09	— 5,760	64,600
4	4.55	11.90	27.80	330.82	4.02	111.50	+0.50	+0.27	+1.23	+2.28	+0.20	—0.07	— 4,480	64,250
5	4.65	12.35	30.35	374.82	4.40	133.00	+0.90	+0.39	+1.81	+4.18	+0.35	—0.04	— 2,560	64,100
6	4.75	12.60	32.60	410.80	4.70	152.60	+1.20	+0.44	+2.09	+5.69	+0.47	+0.03	+ 1,920	64,100
7	4.80	12.85	34.70	446.00	4.99	173.20	+1.36	+0.55	+2.64	+6.53	+0.53	—0.02	— 1,280	64,100
8	4.85	13.00	36.50	474.50	5.28	192.00	+1.50	+0.57	+2.77	+7.27	+0.59	+0.02	+ 1,280	64,050
9	4.88	13.15	38.65	508.70	5.58	215.00	+1.60	+0.60	+2.93	+7.82	+0.63	+0.03	+ 1,920	64,000
10	4.88	13.25	41.20	547.00	5.95	215.00	+1.69	+0.60	+2.93	+8.27	+0.66	+0.06	+ 3,840	64,000
11	4.85	13.25	43.40	575.00	6.25	271.00	+1.66	+0.57	+2.77	+8.04	+0.65	+0.08	+ 5,120	64,100
12	4.80	13.25	45.25	600.00	6.52	294.50	+1.61	+0.55	+2.64	+7.73	+0.63	+0.08	+ 5,120	64,150
13	4.75	13.15	47.30	622.00	6.82	322.00	+1.46	+0.44	+2.09	+6.94	+0.56	+0.12	+ 7,680	64,200
14	4.65	12.95	49.65	643.00	7.15	354.50	+1.25	+0.39	+1.81	+5.81	+0.49	+0.10	+ 6,400	64,450
15	4.55	12.60	52.15	657.00	7.52	391.70	+0.86	+0.27	+1.23	+3.92	+0.34	+0.07	+ 4,480	64,600
16	4.30	12.10	55.10	667.00	7.93	437.00	+0.35	+0.11	+0.47	+1.51	+0.14	+0.03	+ 1,920	65,000
17	3.95	11.35	58.50	664.00	8.44	493.00	—0.44	—0.17	—0.67	—1.74	—0.17	0.00	—	65,300
18	3.60	10.35	62.40	646.00	8.99	560.70	—1.60	—0.37	—1.33	—5.77	—0.63	—0.07	— 4,480	65,600
19	2.00	5.90	73.50	434.60	10.66	783.00	—6.13	—2.39	—4.78	—12.26	—2.40	—0.01	— 640	66,000
20							(—12.05)	(—4.233)			(—4.68)	(—0.45)	—28,800	66,500
Sums	84.66	231.03		9304.30	115.52	5337.87	+ = —	+ = —			+ = —			
	Quantities in parenthesis not to be added.						±14.72	±2.93	±14.32	±36.70	±6.26			

of the ordinates of the equilibrium polygon measured from nn′ is zero.

Σi=Σ ordinates of neutral axis—
Σ ordinates equilibrium polygon.

As the algebraic sum of each set of ordinates is zero, their difference is zero, So Σi becomes equal to zero when nn′ and K, K2 are drawn as indicated above.

It is now required to make Σix=0. Draw the diagonal nv′ dividing nvv′n′ into two triangles. Scale all the ordinates of the triangle vv′n measured on the lines 1-20. Place these values in column 6 of *Table III*. Since the triangles vv′n and nv′n′ are equal their centers of gravity will be equidistant from a vertical line through the center of the arch. To find center of gravity of triangle nvv′, multiply each ordinate of column 6 by its lever arm in column 4, place these moments in column 7; divide the sum of the moments in column 7 by the sum of the ordinates, column 6. This is 5337.87÷115.52=46.20 feet from v′ or 6.20′ to the left of the centre line. The centre of gravity of the intercepts of the triangle nvv′ is 6.20′ to the right of the centre line.

In a similar manner the centre of gravity of the ordinates of the equilibrium polygon is found. Multiply ordinates in column 3 by the corresponding lever arms in column 4, placing the results in column 5. The centre of gravity of the equilibrium polygon is 9304.30÷231.03= 40.27′ from v′. This is 0.27′ to the left of the centre of the arch.

To satisfy Σi x=0, the centre of gravity of the two triangles must coincide with the centre of gravity of the equilibrium polygon.

From the discussion that preceded this example it was shown that the area, or sum of ordinates of each of the triangles was proportional to the end ordinates vn and v′n′. So without increasing the total area of the two triangles the ordinates, vn and v′n′, are altered so that the centre of gravity of the two triangles together will coincide with the centre of gravity of the equilibrium polygon.

Referring to *Fig. 5* T and T′ represent the value of the sum of the ordinates of the triangles nvv′ and nv′n′, each equal to 115.52. R represents the sum of the ordinates of the equilibrium polygon, equal to 231.03.

Now the distance from R to T′ is equal to 6.20—0.27=5.93 and the distance from R to T is 6.20+0.27=6.47.

For the centre of gravity of the two triangles to coincide with the centre of gravity of the equilibrium polygon new values of T and T′, represented by T″ and T‴, respectively, must be found.

These values will be proportional to 5.93 and 6.47. To do this divide the sum of the trial end ordinates vn+v′n′ into parts proportional to 5.93 and 6.47.

$$vn + v'n' = 23.10$$

$$vm = \frac{6.47}{12.40} 23.10 = 12.05$$

$$v'm' = \frac{5.93}{12.40} 23.10 = 11.05$$

Lay off vm=12.05′, and v′m′=11.05′ on the diagram, and draw the new closing line mm′.

Measure the ordinates included between closing line mm′ and the equilibrium polygon and place these in column 8. The distances above mm′ are considered positive and below, negative.

In the same manner scale the ordinates included between K, K2 and the neutral axis of the arch. Place these values in column 9. The sum of the positive values in column 8 equals the sum of the negative values. In the same manner the positive and negative values of column 9 are equal, thus satisfying the equation Σ i x=0.

To make Σ i y=0: From the theoretical discussion it was shown that this condition would be satisfied by making Σ y times the ordinates of arch= Σ y times ordinates of equilibrium polygon. The ordinates are measured from K, K2 and mm′ respectively.

In column 10 place the products of arch ordinates (column 9) and the corresponding y-ordinates (column 2). In column 11 place the products of equilibrium ordinates (column 8) and the corresponding y-ordinates (column 2).

The sum of the arch products is +14.32 and of the equilibrium products is +36.70.

In order to make these equal multiply column 8 by $\frac{14.32}{36.70}$ and place the corresponding products in column 12. The values given in column 12 are the intercepts of the true equilibrium polygon. The pole distance of the true equilibrium polygon is 64,000 lbs., found by multiplying 25,000 by $\frac{36.70}{14.32.}$ The measure of bending moments at the various sections will be the difference between the values of the intercepts of the arch closing line and the equilibrium closing line. These differences are found by subtracting the values in column 9 from the corresponding values in column 12. The results are placed in column 13. The bending moments in foot-pounds are gotten by multiplying the values in column 13 by 64,000. This is based on the principle that the bending moment at a given section for any loading is equal to the product of the assumed pole-distance of the equilibrium polygon and the ordinate of the equilibrium polygon at that section.

The true line of pressure in the arch is readily constructed by laying off to scale the intercepts given in column 13, plus distances being measured above, and minus distances below the neutral axis of the arch ring. The series of lines joining these points will be the true pressure line of the arch.

Through the assumed pole draw a line parallel to mm′. On this measure off horizontally a distance of 64,000 lbs. from the load line. The point found will be the true pole. Rays drawn from this point will give the directions of the strings of the equilibrium polygon. Each of these can also be resolved into components perpendicular to the section and perpendicular to the neutral axis at corresponding parts of the arch. These components may be scaled and will give the direct thrust and shear, respectively at each section.

Column 15 gives the values of the thrusts at the various sections. found by resolving the rays of the equilibrium polygon into rectangular components as just indicated.

NOTATION.—The following notation will be used throughout in this discussion:—

Let Q = thrust in lbs. on a slice of the arch ring one inch thick.

M = bending moment in inch.-lbs. on a slice one inch thick.

h = thickness of concrete in inches at any given section.

d = distance center to center of bars in the same vertical plane.

Is = Moment of inertia of steel for one inch slice.

Ic = moment of inertia of concrete for one inch slice.

Ss = Resisting moment of steel for one inch slice.

$$Ss = Is + \frac{d}{2}$$

fs = maximum stress per sq. in. in steel.

fc = maximum stress per sq. in. in concrete.

Es and Ec = moduli of elasticity of steel and concrete, respectively.

As = Area of steel in sq. in. per inch slice.

a and b = the part of entire load carried by the concrete and by the steel respectively.

W = total load.

Wc = load carried by concrete.

Ws = load carried by steel.

If the elastic limit of the concrete is not to be exceeded we have

$$\frac{Wc}{Ws} = \frac{Ec\ Ic}{Es\ Is} = M \qquad (15)$$

$$a = \frac{m}{1+m} \qquad (16)$$

$$b = \frac{1}{1+m} \qquad (17)$$

Then from mechanics we have

$$fc = a\left(\frac{Q}{h} \pm 6\frac{M}{h^2}\right) \qquad (18)$$

$$fs = b\left(\frac{Q}{As} \pm \frac{M}{Ss}\right) \qquad (19)$$

Formulas 18 and 19 give the maximum stresses in the steel and concrete when the stresses at any given section are known.

In formulas 18 and 19 a positive sign always signifies compression and a negative sign.

It will be seen that the pressure line passes within the middle third of the arch ring at every point, which should be the case in every properly designed arch whether reinforced or not.

The method of proportioning the steel for reinforcing at the various sections will be given, the same method being used throughout to compute the maximum stresses at the critical sections. If the critical sections are so proportioned that the maximum safe working stresses in the materials are not exceeded all other sections of the arch ring will be sufficiently strong to carry the loads imposed upon them.

Let us consider the crown section to see if it is thick enough to resist crushing. The total thrust on the crown section for an inch width is 5,330 lbs. and the area of the crown section is 15 sq. ins. This gives a stress of 356 lbs. per sq. in. which is safe.

The first section to be considered in proportioning the amount of steel reinforcing to use will be section 11. For a trial let it be assumed that the distance from the centre of the reinforcement to the outer edge of the concrete is to be 2″. The bars will be symmetrically placed with respect to the neutral axis. Assume a value of Es ÷ Ec = 15, which is a safe value to use for 1-2-4 concrete.

Referring to *Table IV*, we find

Q = 5330 lbs.; M = 3840 in.-lbs. h = 15 in.

Also, d = 11 in. from the assumed spacing of the bars. Try a reinforcement of steel equal to .75 per cent of the area of the concrete. Then we have

$As = 0.1125$ sq. in.

$$Is = (5.5)^2 \times 0.1125 = 3.40$$

$$Ss = 3.40 \div 5.5 = 0.619$$

$$Ic = \frac{15^3}{12} = 281.25$$

$$\frac{Wc}{Ws} = \frac{Ec\ Ic}{Es\ Is} = \frac{281.25}{15(3.40)} = 5.51 = m \text{ (Equation 15)}$$

From equations 16 and 17

$$a = \frac{5.51}{1+5.51} = 0.85$$

$$b = \frac{1}{1+5.51} = 0.15$$

Fig. 4

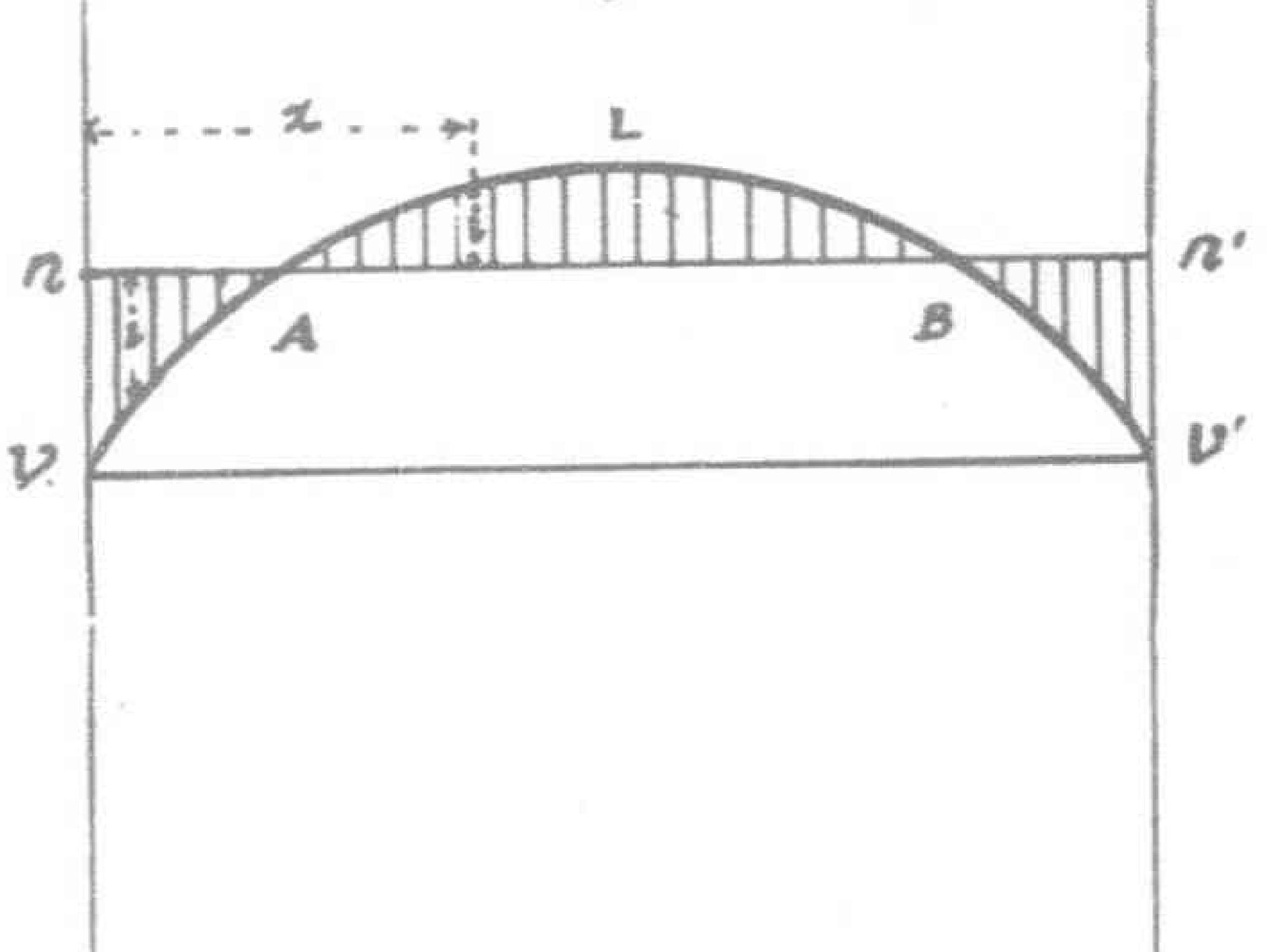
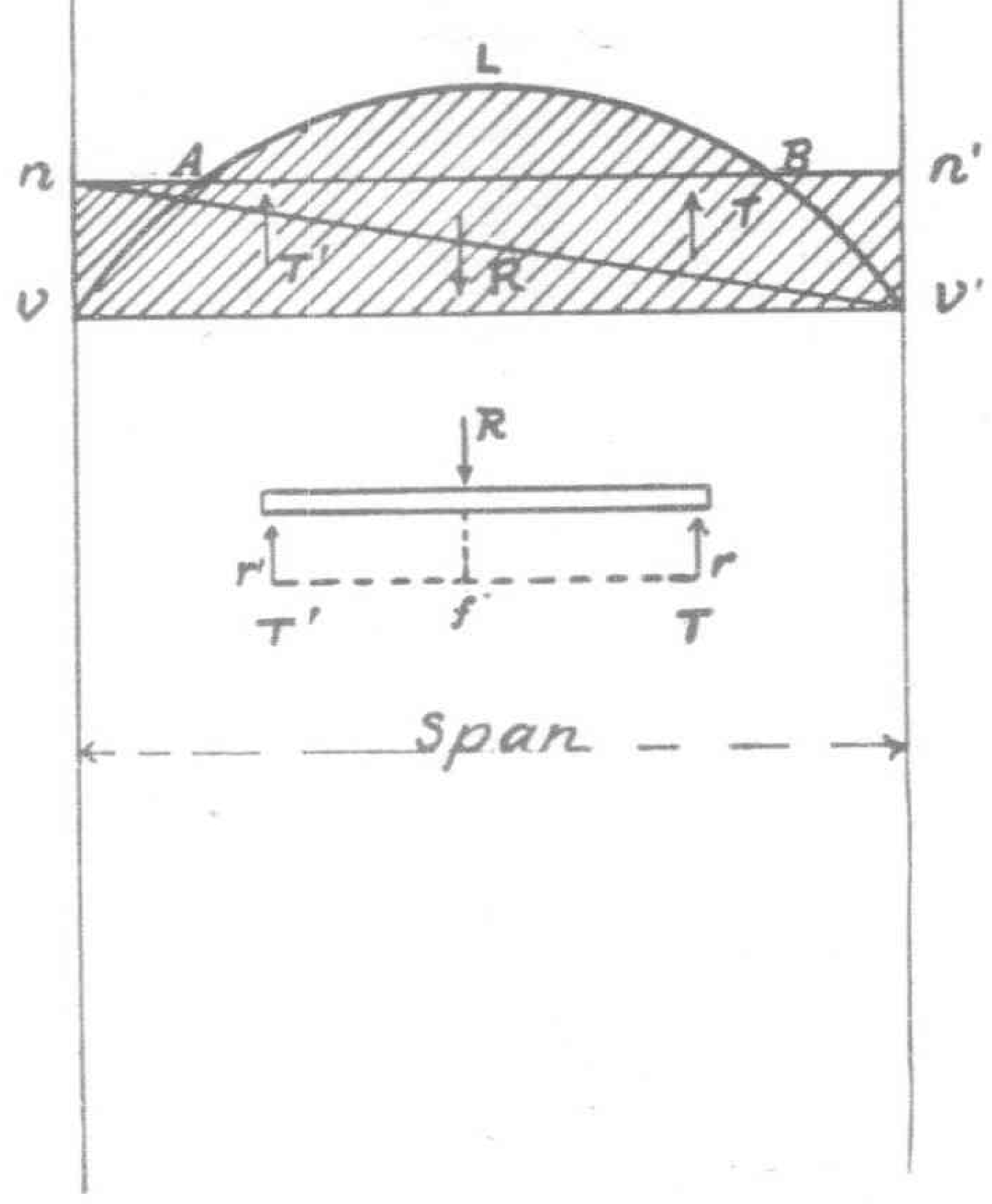


Fig. 5



Substitute the above values in equations 18 and 19

$$fc = 0.85\left\{\frac{5330}{15} \pm \frac{6\ (3840)}{225}\right\}$$

$$= \left\{\begin{matrix}389 \text{ lbs. per sq. in.}\\ 217 \text{ lbs. per sq. in.}\end{matrix}\right\}$$

$$fs = 0.15 = \left\{\frac{5330}{0.1125} \pm \frac{3840}{0.619}\right\}$$

$$= \left\{\begin{matrix}(8043 \text{ lbs. per sq. in.}\\ (6180 \text{ lbs. per sq. in.}\end{matrix}\right\}$$

It will be seen that the allowable stresses in both materials are not exceeded and that the stress in the concrete is very near the full safe working strength. No appreciable reduction in the area of steel used can be made without increasing the stress in the concrete beyond the safe allowable stress.

In like manner let us examine section 12.

Q = 5340 lbs. M = 5120 in.-lbs.

h = 15.3 in. d = 11.3 in.

Since the same bars will be used throughout the arch ring we have as before, As = 0.1125 sq. in. and

$$Is = (5.65)^2 \times 0.1125 = 3.61$$

$$Ss = 3.61 \div 5.65 = 0.638$$

$$Ic = \frac{(15.3)^3}{12} = 305.4$$

$$\frac{Wc}{Ws} = \frac{EcIc}{EsIs} = \frac{305.4}{15(3.61)} = 5.64 = m$$

$$a = \frac{m}{1\ \ m} = \frac{5.64}{6.64} = 0.85$$

$$b = 0.15$$

$$fc = 0.85\left\{\frac{5340}{15.3} \pm \frac{6(5120)}{235}\right\}$$

$$= \left\{\begin{matrix}408 \text{ lbs. per sq. in.}\\ 185 \text{ lbs. per sq. in.}\end{matrix}\right\}$$

But this exceeds the allowable stress assumed (400 lbs.) and the section will have to have a larger area of steel, or the thickness of concrete must be increased. Inasmuch as the stress in the concrete is so near the safe limit, it would seem more economical to increase the area of steel slightly than to increase the area of concrete at this section.

Another trial of this section is made using 0.13 sq. in. of steel per inch width of the arch. This gives the maximum stresses in the concrete of +398 and +181 lbs. per sq. in. which are allowable. The values of a and b found for the new assumed value of area of steel are 0.83 and 0.17, respectively. The stresses in the steel are found to be +7214 and 5120 lbs. per sq. in. Since all these stresses are within safe limits section 12 will have sufficient reinforcement if 0.13 sq. in. of steel per inch width of arch is used.

The maximum area of steel required at any section determines the area of steel at all other sections of the arch. So if it is found that 0.13 sq. in. of steel is sufficient for the remaining sections of the arch, this will be the proper amount of steel to use. This area is equivalent to pairs of ¾″ round bars spaced 3-⅜″ centre to centre. Any other bars may be used provided that an equivalent area of steel is secured. In general, bars should not be closer together than three diameters centre to centre.

Transverse reinforcement should also be provided, usually amounting to about ⅓ to ⅕ the area of the longitudinal bars. That is, the transverse reinforcement would usually consist of pairs of bars of the same size as the longitudinal bars but spaced from three to five times as far apart.

SHEAR.—Each section of the arch should be examined to see that the safe shearing strength of the concrete is not exceeded. Should it be found that any section is subjected to excessive shearing-stress, shear-bars should be provided. A satisfactory method of placing shear bars is to incline them upwards toward the abutments, the ends of the bars being hooked over the upper and lower longitudinal bars. The diameter of shear bars would depend largely on the amount of shear to be carried, though in general it would be from ¼ to ¾ the diameter of the longitudinal bars. The spacing where shear must be provided for should not be less than the depth of the arch ring at such sections. In many cases it will be found that no shear bars are required.

TEMPERATURE STRESSES.—Stresses due to temperature changes may be computed by any of the methods given in the standard textbooks on mechanics. The stresses thus found may be added to those already found by the method explained, and the various sections designed to carry the stresses due to all dead and live loads and temperature changes. Or, the thrust at the crown due to temperature changes may be computed and added to the thrust due to dead and live loads. A new equilibrium polygon would then be constructed with a pole-distance equal to the sum of the two thrusts. From this the stresses at the various sections could be determined graphically, as before.

However, the usual range of temperature is so small in the Philippines that in most cases temperature stresses may be neglected without danger.

CONSTRUCTION.—Much of the sand, gravel and stone available in the Philippines is of poor quality. Before any important work is undertaken samples of concrete made of the materials proposed for use should be tested, and if not satisfactory better materials should be secured. Much of the gravel available is soft and unfit for concrete, some of the sand and gravel contains shells of various sizes besides organic matter and silt. In examining a reinforced concrete beam that failed in Manila portions of the concrete were found to contain shells having a diameter of an inch or more. Such portions could be broken readily by twisting in the hands, fractures occurring usually near the shell. For this reason it is believed that no shell should enter concrete which is to be reinforced with steel. Sand should be hard, clean and coarse. A microscopical examination of sand is often an aid in selecting a good grade. Sharpness is not absolutely essential though it makes a slightly stronger concrete.

The specifications for stone should require hard, sound stone free from earthy or vegetable matter and not larger than will pass a 1½″ ring for all reinforced concrete and not larger than will pass a 2½″ ring for plain concrete work. Weathered rock should be avoided, as it is not productive of good results.

A fair grade of Portland cement may be procured in the local market and this is of satisfactory quality. To insure uniform quality of cement every second or third barrel should be sampled and tests made when used in important work.

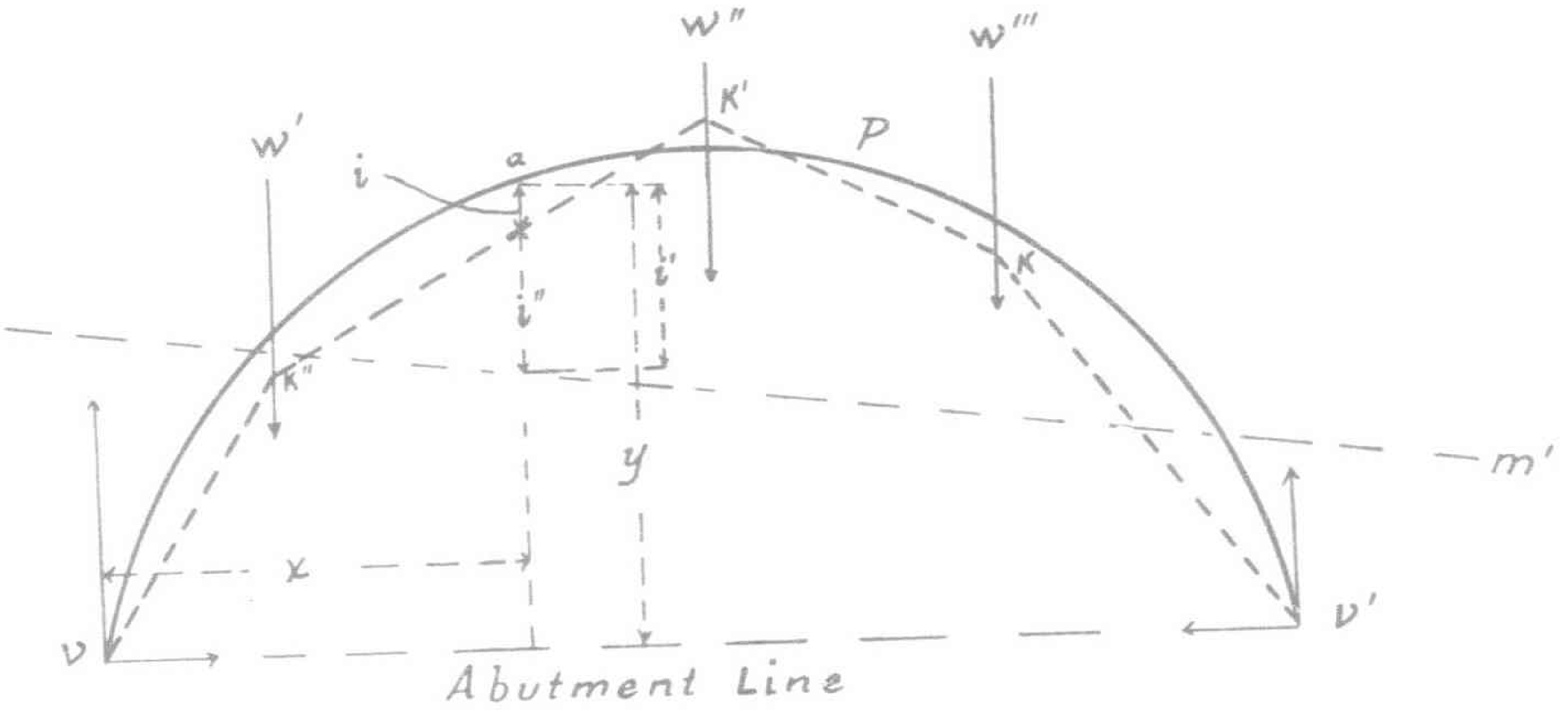


Fig 6

The metal used in a large part of the reinforced concrete work done in the Philippines is mild steel containing not more than 0.15 per cent carbon. Wrought iron may be used interchangeably with the mild steel the use of either obviating the necessity of testing such materials. An additional advantage is that either of these materials may be purchased in the open market at almost any time.

The most important feature of reinforced concrete after securing proper materials is to secure thorough mixing and placing. Almost any of the standard specifications used in the United States will prove satisfactory for mixing and placing concrete. The mixture that seems to give best results here is a rather wet but not *sloppy* one. This will require puddling with spades and will probably secure a better adhesion between the steel and concrete than the mixtures containing less water and requiring tamping. Careful supervision should be maintained on all concrete work for the purpose of securing as high quality workmanship as possible and strict conformity to the specifications.

Frequently it will be found that the steel bars of commercial lengths are not long enough to extend the full lengths shown in the plans. In such cases the bars should overlap a distance not less than 50″ to develop the full safe strength of the bar.

Reinforced concrete work should be wetted thoroughly every day for a week after placing and should be protected from the sun for at least two weeks if the best results are to be obtained. *Suale*, a coarse matting, is cheap and can be used to protect such work from the sun; *burlap* or *cogon* grass or wild banana stalks and leaves can be placed on top of completed work and kept wet at little expense. A simple expedient for keeping concrete floors wet is to spread about two inches of sand over the entire surface as soon as the concrete has set, the sand being wet down at intervals. In this manner the concrete is wetted and protected from the sun at slight expense. The sand can be left on the floor till the building is completed, affording considerable protection against the blows and injuries that the concrete is certain to receive.

FORMS.—Forms for small culverts may be made of a rough lumber frame work covered with suale or sheet-iron, though for the larger spans well braced ribs of trusses should be used usually spaced from 3 to 5″ apart with lagging of such depth that the maximum deflection will not exceed an eighth of an inch. If lightly toe-nailed to the ribs of false-work the lagging may be used a number of times before being discarded. A very satisfactory method of smoothing over the irregularities of the surface of the lagging after it is in place is to coat the entire surface with a very thin layer of a rather wet clay. This is done by simply taking a ball of wet clay and rubbing the surface of the lagging until quite smooth and all cracks in the lagging are filled up. This should be done just before the concrete is put in place.

On all arch or beam spans greater than 20″ the forms should remain for a period of at least 30 days. before removal of arch forms the back-fill should be made and wet down well.

TABLE IV.—STRESSES IN ARCH RING.

Governing Points.	Moments in lbs. on Section 1″ wide	Thrusts on Sec. 1″ wide	Assumed Depth of Ring	Assumed Depth of Ring Ins.	
			ft.		
V′	28890	5540	4.67	56.0	Critical Point.
1	17960	5500	2.60	31.2	
2	19200	5450	1.75	21.0	Critical Point.
3	7040	5420	1.60	19.1	
4	5760	5380	1.48	17.25	
16	4480	5380	1.45	17.4	
15	6400	5360	1.37	16.5	
14	7680	5350	1.35	16.2	Critical Point.
13	5120	5340	1.30	15.6	
12	5120	5340	1.27	15.3	Critical Point.
11	3840	5330	1.25	15.0	Critical Point.
Centre.			1.25	15.0	

ERRATA.—The pole-distance shown in the graphic diagram was obtained by the deflection polygon method. The value found by this method is not altogether correct. The correct value of the pole-distance determined as described in this paper is 64,000 lbs. while the diagram shows the pole-distance to be 66,850 lbs.

In the January number of THE REVIEW the following errors are noted:—Page 243 in formula (6) X should be x; page 245 in formula (9) place period to indicate multiplication in place of the first sign of division.

SZECHUEN-HANKOW RAILWAY

Japanese engineers have surveyed routes of various sections in Hupeh for the Szechuen-Hankow Railway at the request of Viceroy Chang-Chih-tung. The main line will start from the outside of the western gate of Han Yang (opposite Wuchang) and then run along the upper stream of Hankow for two miles by the south bank of the Hsiang (Han) River and then after coming to the plain there pass through Tsaitien, Shentao and Sincheng (where cotton and grain are produced) and then reach Shayang, and then turning to the south-west pass through Chingmenchow, Tang-yanghsien, etc., (mostly hilly, producing hemp), and reach Ichang, where connection will be made with the Yangtsze steamship lines. From Ichang the line passes through the mountain ranges of Chungshan and enters into Szechuen at Wanhsien, where the line will connect with that in Szechuen. A branch line starts from Shayang-chin on the left bank of the Hsiang (Han) River to Shashi on the right bank of the Yangtsze, and another line starts from Chingmenchow along the Hsiang River to the north, passing through Ichang and reaches Hsiang yang-fu so as to get cargoes from the western boundary of Honan and southern boundary of Shensi. The difficult portion of the engineering works is that between Ichang and Wanhsien, where there are mountain ranges making it difficult to cut routes. Viceroy Chang Chih-tung at first intended to have Kwang hsui-tien on the Peking-Hankow Railway as the starting point in the Szechuen-Hankow Railway. However, the Japanese engineer-in-chief suggested that it is not necessary to have the station competing with the Peking-Hankow Railway and Kwang hsui-tien is quite in the inside of a plain distant from water transport, thus inconvenient to supply cargoes; and that it is far better to have the terminus near Wuchang, Hankow and Hangyang, being in a very convenient position for land and water transportation.

GHIRBI COALFIELDS, MALAYA

These coalfields, which are situated about 200 miles to the north of Penang, near the Island of Tongkah, on the west coast of the Malay Peninsula, have been exploited by some enterprising residents of Penang and it is understood that before long the syndicate's *black diamonds* will be placed on the Penang market. Recent tests at the mines went off very well, and as the supply is practically inexhaustible and the fields are near Penang, and there is deep water close to the syndicate's wharf, it is fair to assume that, with the cheap transport thrown in, to the many attractions to the shipping and aids to the development and the vast resources of this country, will soon be added a plentiful supply of cheap and good steam coal, which while proving of incalculable benefit to various trades and industries both in the Straits Settlements and the neighboring British Protected States (Perak, Selangor, Negri Sembilan, and Pahang) will enable ocean liners and coasters to replenish their bunkers in Penang at a much lower cost than has hitherto been thought possible. The peninsula railways (Government concerns) should be great gainers, and that would mean advantages of no mean order for the public, who would be able to travel and transport their goods at lower rates than now obtain.

With cheap fuel, added to the plentiful supply of tin, ever-increasing quantities of the best plantation rubber, tropical produce of every description in abundance, and Governments pushing ahead with railways, roads, docks, and improvements in harbors, he must be a rabid pessimist indeed who would fail at this time to take a roseate view of the prospects of Malaya as a whole, and Pulau Penang in particular.

TOKYO-OSAKA ELECTRIC RAILWAY PROJECT

Some particulars are published as to the Tokyo-Osaka Electric Railway project. The Tokyo terminus would be in the Shimo-Shibiya suburb of Tokyo, that is to say, near the site of the power-station of the former Tokyo Electric Railway. The road would be on the *daisankio* system, and the gauge would be 4′ 8½″, a double track. At the Osaka end the terminus would be the Noda-mura suburb, and the places of call *en route* would be Shizuoka, Matsuda, Nagoya and Kameyama. The establishment expenses are to be obtained by charging each promoter 10 *sen* per share taken by him. The distance of the proposed route is 287 miles, being thus from 60 to 70 miles shorter than the State Railway, and an average speed of 50 miles an hour would easily enable the journey to be made in 6 hours, including stoppages, against 22 hours by the present ordinary trains, and 13 hours by the express trains. The engineering experts who spoke at the meeting in the Imperial Hotel recently, dwelt upon the glaring incapacity of the existing railway to meet the needs of communication between the two cities. They also insisted that no improvements in management can bring the State line to the level of the occasion, its appliances and capabilities being limited. The estimated cost of laying and equipping a line of the nature projected is -Y-160,000 per mile, and if the distance be taken at 300 miles, a capital of about -Y-100,000,000 would be required for the double line. The road would be able to transport a whole division of troops in one day if occasion arose. Charges would be of two kinds, -Y-8 for first class tickets, and -Y-4 for ordinary tickets, and the estimate is a net profit of about 9 per cent.

CROSSING SIBERIA BY RAIL

Vice-Consul-General Nelson Fairchild, of Mukden, reports to Washington that notwithstanding the prevailing idea that political disturbances have seriously interrupted the railway communications throughout Russia, the journey through Siberia and Northern Manchuria may be made with only the ordinary difficulties which beset the traveler. As information regarding the trip from London to St. Petersburg and across Siberia is not readily obtainable, the following information from Mr. Fairchild will be of interest:

Trains for St. Petersburg leave the Victoria station, London, daily at 9 a. m. to connect, *via* Dover, with the Nord Express at Ostend, which reaches Berlin at 7.40 next morning. The regular St. Petersburg express leaves at 10 o'clock, and after a 13 hours' trip the Russo-German frontier at Eydtkuhnen-Wirballen is reached. It is here necessary before changing trains, owing to the difference between the Russian and the German gauge, to pass the Russian customs and to submit passports for *visé* by the police authorities. Baggage is handled by a corps of porters, and the traveler is able to pass the time before the train leaves, at 1 a. m., in one of the excellent restaurants which are to be found at all the larger Russian stations. Those who wish to be certain of a berth in a well-lighted car should telegraph ahead. Leaving at 1 a. m., it arrives at St. Petersburg at 6.40 the following evening.

ST. PETERSBURG TO MOSCOW AND IRKUTSK.—The night *train de luxe* leaves St. Petersburg for Moscow at 10.30 p. m., arriving at 10.30 the following morning.

The regular Government trans-Siberian express leaves Moscow twice a week, on Sundays and Thursdays, at 12.10 a. m. (local time), the car-lit train leaving on Wednesdays. By taking the latter, however, it is necessary to wait one day at Irkutsk, while the other two trains, with two hours' leeway, connect with the Vladivostok express, and, except for the lavatory accommodations, the ordinary express carriages are quite as comfortable as the more expensive lighted cars. It is an eight-day trip without change from Moscow to Irkutsk. At the latter station, on account of the change of trains, it is necessary to secure a new berth. It will be found more convenient to have the agent in Moscow secure the ticket by telegraph. It is necessary to watch the baggage, as the platform is crowded and thieves are not uncommon.

Irkutsk to Harbin and Mukden.—From Irkutsk the train passes south of Lake Baikal, running very near the water's edge over a hastily constructed roadbed which requires constant watching. It is proposed to build a second line farther to the south, avoiding the mountains which surround the lake. The run to Harbin is five days without a break, at Karamskaia the line changing from the trans-Baikal to the Chinese Eastern Railroad. At about 11 a. m. (local time) the train reaches Harbin, where those going south must change to the old Port Arthur line, the express going through to Vladivostok, arriving there thirty-six hours later.

The south-bound train leaving Harbin at 10.30 p. m. for Changchun (Kwangchentzu) does not compare with those on the main line, consisting of ordinary post cars. Changchun, the last station on the Russian line, is reached at 10 the next morning.

The Japanese railroad begins 5 miles south of Changchun. The schedule has not yet been completed, but there is at least one train a day each way, consisting of one second, a number of third-class, and box cars. Mukden is about sixteen hours away on the main Port Arthur line.

Accommodations and Food.—The St. Petersburg express leaving Berlin is composed of comfortable first and second class vestibule carriages, with a good dining car attached. From Wirballen to St. Petersburg there is a regular carriage-lit train, while the express between St. Petersburg and Moscow is the best train in Russia. It is made up of lighted cars of the latest type. The Moscow-Irkutsk Government express consists of first and second class cars only. The first-class compartments are for two or four, while the second-class accommodates four persons. Each compartment is fitted with a small table and electric reading light, and there is a lavatory at either end of the car. From Irkutsk on the trains are built on the same plan, but slightly larger, with three lavatories.

On all the Russian trains (except that between Harbin and Changchun) there is a restaurant car, where the prices are reasonable and the fare, though good, is monotonous. As the stops are long, a change of menu may be found at the station buffets. It is unsafe to drink unboiled water, but Russian and other mineral waters are supplied at low rates. The light Caucasian wines are good and cheaper than French or German clarets or hocks. Russian beer is fairly good, and at the stations peasants offer bottles of milk for sale, while tea or coffee may be had at any hour of the day.

Baggage, Language, etc.—Baggage may be registered through to Harbin or Vladivostok on the payment of a not excessive charge, but only 54 pounds is allowed free on a single ticket. The staterooms, however, are large enough to permit the carriage of pieces the size of a small steamer trunk.

Neither towels, soap, nor toilet paper are furnished on the trains. It is well, also, to buy such postage stamps as may be needed for letters to be posted en route, as they are difficult to obtain at the stations. Blankets are necessary both at Harbin and on the road south.

A knowledge of French or German, preferably the latter, is most useful, as the porters do not, as a rule, speak English. An open letter to the station masters from the minister of ways and communications will be found valuable, should any difficulty arise, and a passport visaed by the Japanese minister would be useful in transferring from the Russian to the Japanese lines at Changchun.

Condition of Roads, Commercial Towns, etc.—The rails throughout are very light, about 60 pounds in weight, and the roadbed is poorly ballasted. Both show the effects of the heavy traffic. From Cheliabinsk on there are single sidings every 5 versts, with many more at each station. The railroad is divided into three parts—the trans-Siberian from Moscow to Cheliabinsk and Irkutsk, the trans-Baikal from Karamskaia to Vladivostok.

Connecting with the trans-Siberian line there are branch railroads from Cheliabinsk to Ekaterinburg and Perm, shortly to be connected with a road from St. Petersburg via Vologda; from Taiga to Tomsk, and from Karamskaia to Stretensk. Cheliabinsk, moreover, within another year will be connected with Irkutsk by a second line to the south, and a new circum-Baikal as well as a Stretensk-Harbarovsk line is contemplated. Water routes and connecting railroads, both constructed and projected, supply the main arteries, and only the network of the connecting lines is necessary to complete the opening of the country.

The towns along the line appear to be fairly active, growing places, with their saw and flour mills, distilleries, and factories. The larger ones, such as Cheliabinsk, Petropavlosk, Omsk, Kainsk, Taiga, Ilanskaia, Nijnieoudinsk, Irkutsk, and Tchita, show signs of great commercial activity.

Population and Resources.—The bulk of the population of Siberia is made up of emigrants and exiles from Russia proper. At present the exiles form only from 8 to 9 per cent of the whole, and this proportion is decreasing, while the number of voluntary emigrants is growing each year. The latter are chiefly farmers, who are given Government land, rent free for a number of years, after which they are obliged to pay a small tax.

The native population consists of nomadic tribes—the Kirghiz, Tartars, Turks, Mongols, Bukhariots, Samoyedes, and Buriats—living in felt tents. They are not agricultural but pastoral races. Their flocks and herds provide food, clothes, and shelter, and they rely on the frequent fairs held at large towns to meet and exchange commodities for their other needs.

The natural resources of the country are great, large mineral deposits being found throughout; gold, which is the most important, forming one of the chief sources of wealth. After it, in the order named, are coal, iron, silver, lead, and salt, as well as quantities of precious stones. These mines are worked by primitive methods, though in the Tomsk district some modern American machinery has been introduced, and the output is at present very considerable and annually increasing. Although the numerous coal and iron deposits have not been extensively exploited, coal is furnished in sufficient quantity for railroad use, and a certain amount of pig iron is exported. Silver, lead, salt mines, and oil wells, though not as important, are profitable, and contribute to the general wealth of the country. Timber also, if felled under proper restrictions, should be a constant source of revenue both to the Government and to the lumbermen.

Industries.—A certain amount of capital is invested in canneries, for the country abounds in rivers and lakes, which are supplied with fish in abundance—salmon, sturgeon, sterlet, and trout.

Farming is the chief industry of Siberia, for the Russians are essentially an agricultural people. Partly, however, owing to the crude implements in use and partly to the community ownership of land, the production has been small in comparison with the fertility of the soil. Agricultural machinery has not been employed to any great extent, notwithstanding the enormous area capable of cultivation; and the peasantry are content to work their farms by hand. Common ownership of land, as in Russian Siberia, interferes with proper fertilization and rotation of crops, for the land is each year divided by their head among the various members of the community according to the size of the families. The peasants consequently regard any attempt to improve land that they are to part with at the end of the year as a waste of time and money. Furthermore, each family's land is arbitrarily subdivided into three portions, one for planting, one for grazing, and one to lie fallow, reducing the possible cultivation to two-thirds of its natural extent.

In spite of the defects in the Russian system great quantities of grain are exported annually. Wheat is the principal crop, but rye, barley, oats, flax, linseed, and beet root are cultivated as well. In many parts the absence of snow and the shortness of the summer presents serious difficulties, yet two crops are almost invariably handled each year.

Cattle, sheep, and horse breeding form another important industry, and furnish the supplies used by the meat canners, as well as the establishments for the production of cheese, butter, tallow, and soap.

Imports, Exports, Rivers, and Crops.—The tea traffic between Siberia and Mongolia and China forms the largest import trade. Other imports are piece goods, groceries, glass, finished metal goods, and pottery. Exports consist of grain, flour, linseed, coal, tallow, butter, cheese, hair, skins, furs, and cattle.

Out of the great number of Siberian rivers few are navigable, and those that are are closed during such a large part of the year that the

(Continued on page 335.)

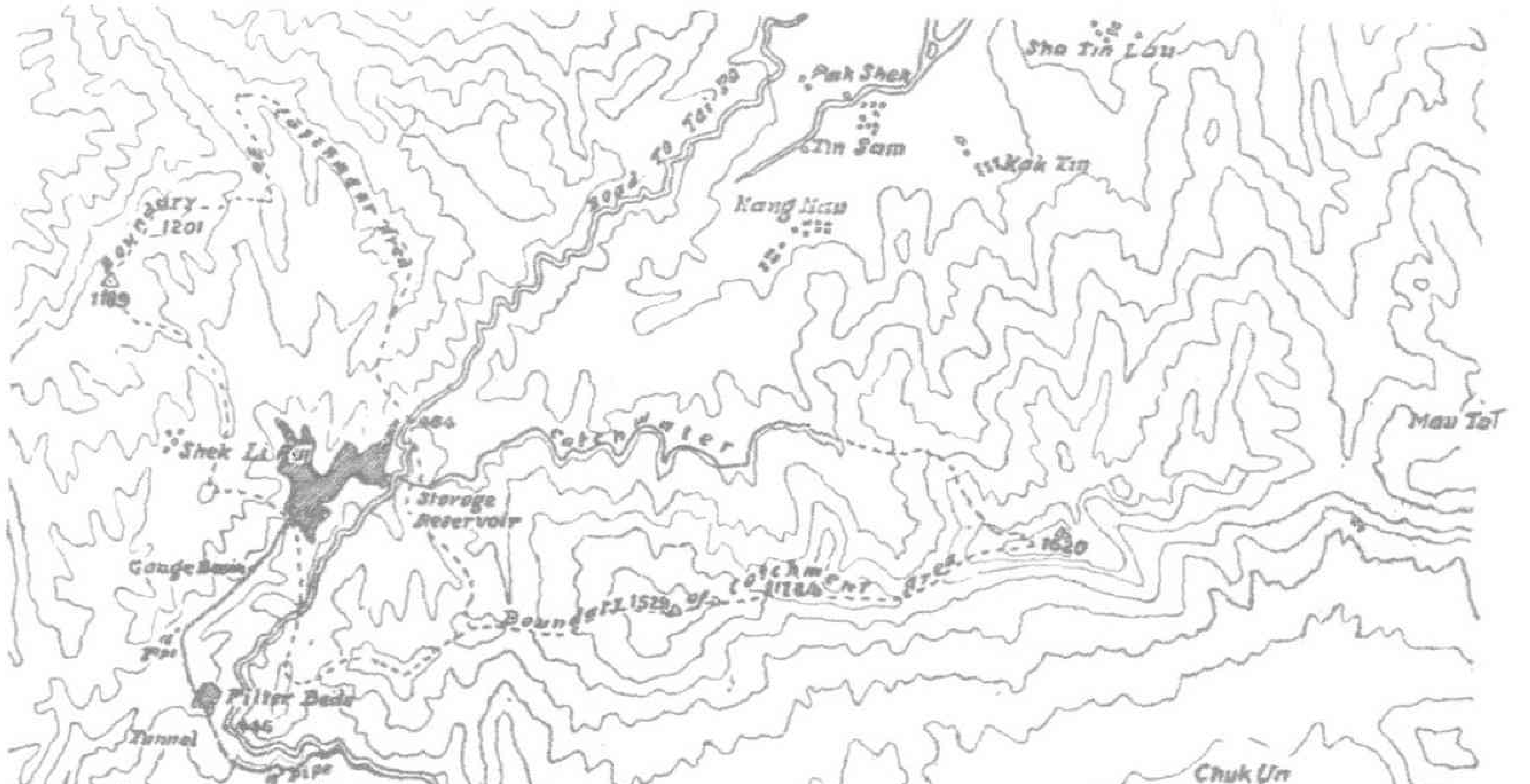
GENERAL SCHEME AND CONSTRUCTION OF THE KOWLOON "HONGKONG" WATERWORKS SYSTEM

(Specially written for THE REVIEW by L. Gibbs, A. M. Inst. C. E.)

Prior to the year 1898 the mainland portion of the Colony of Hongkong comprised an area of about four square miles only. In 1891 the population of this area, known as the Kowloon Peninsula, including those living in boats near the shore, amounted to 26,500. It was about this date that the necessity for the public supply of water first forced itself upon the attention of the Government of the Colony. It being undesirable to obtain water from what was then Chinese territory the sources of supply were consequently somewhat limited. A scheme was proposed by Mr. Osbert Chadwick, Consulting Engineer to the Colonies, for obtaining water from the flat sandy valleys in the northern part of the peninsula. This scheme was carried out under the direction of Mr. F. A. Cooper, Director of Public Works for the Colony of Hongkong. The works were completed in 1895 at a cost of $116,000 (Mexican currency). Three valleys, having a joint area of 220 acres, were reserved as a collecting area, the water in the flat sandy bottoms of these valleys being intercepted by collecting pipes and led to shallow wells, below which dams were built across the valleys to prevent the escape of water underground. The wells were connected by iron pipes to a tank having a capacity of 150,000 galls., at Yau-Ma-Ti, and from this tank the water was pumped into the distributing mains, the supply being regulated by two small service reservoirs, one near Yau-Ma-Ti 215′ above sea-level and of 160,000 galls. capacity, and the other at Hung Hom 160′ above sea-level and of 90,000 galls. capacity. The minimum supply obtainable was estimated to be 232,000 per day.

ORIGINAL AND REVISED NEW SCHEME.—In 1898 the consumption was found to be rapidly overtaking the available resources of supply, and at the same time the acquisition of what is known as the New Territory, an area of about 350 square miles—the mainland portion of which lies to the north of Kowloon Peninsula—gave promise of increased facilities for obtaining water. Under these circumstances, the writer—then an engineer in the Public Works Department—was instructed to report on the question.

The physical conditions of the country and the incidence of the rainfall made a storage scheme the only practicable one. There are no large watersheds, the country being a jumble of grass-covered hills rising from a few hundred to 3,000′ divided by boulder-filled watercourses, carrying torrents during the summer rains, and almost dry during the northeast monsoon. Here and there these watercourses broaden out into comparatively flat valleys and make possible reservoir sites. The average yearly rainfall is 84″; of this, 58″ fall during the four months of May to August.



GENERAL PLAN OF THE KOWLOON (HONGKONG) WATERWORKS SYSTEM

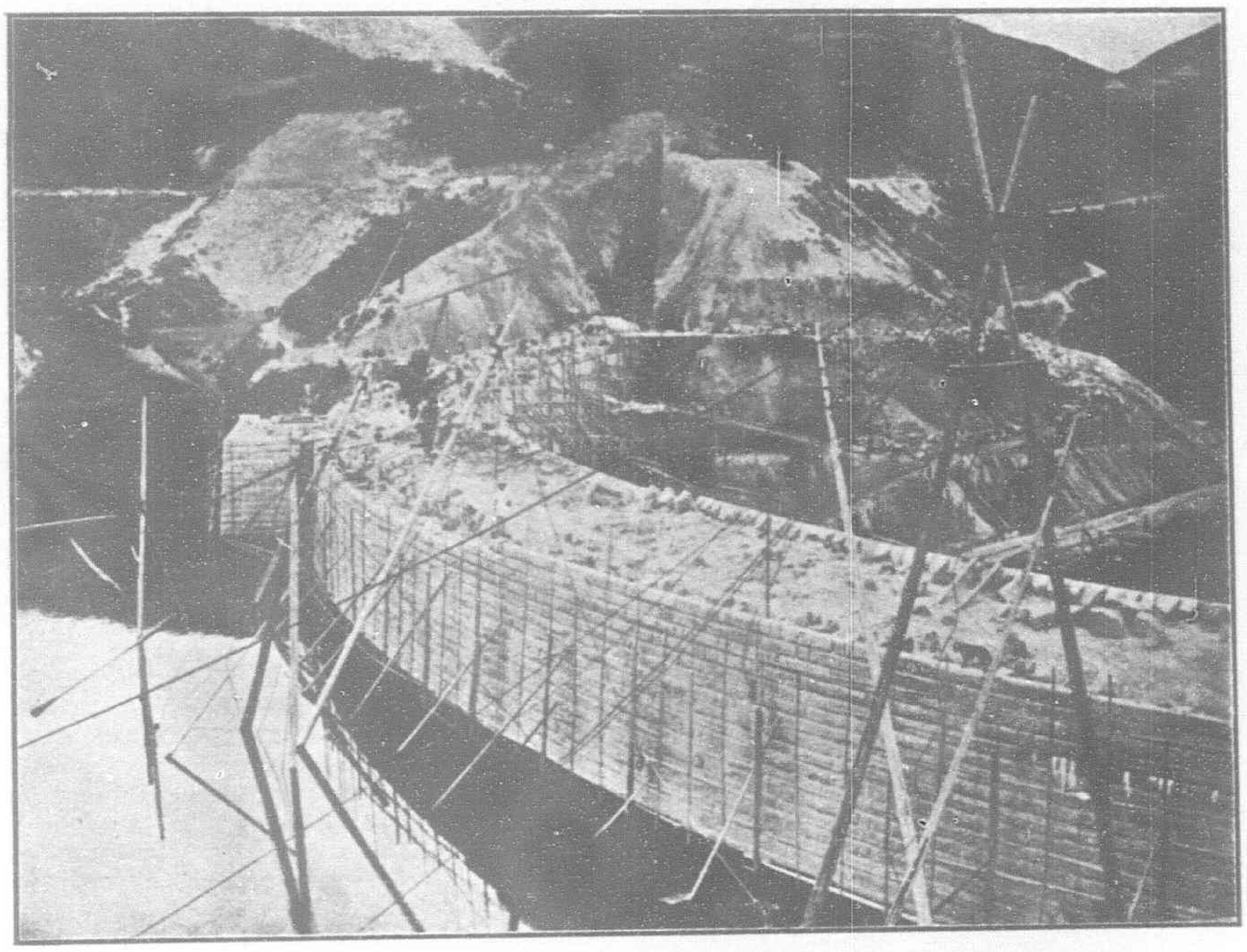
The scheme originally proposed comprised a storage reservoir of 120,000,000 galls. capacity, formed by an earthen dam 65′ high, and commanding a drainage area of 330 acres. The lowest draw off was to have been at 390′ above sea-level, giving ample head above all the inhabited parts of the peninsula; filterbeds, a new service reservoir of 2,000,000 galls. capacity, and extensions of existing mains were provided for. The works were estimated to cost $380,000 (Mexican currency) and to provide a supply of 590,000 galls. a day. This scheme was approved by the local authorities, and submitted to London for the sanction of the Colonial Office. The Consulting Engineer, Mr. Chadwick, while generally approving the scheme, advised that a masonry dam be substituted for the proposed earthen dam.

About the time that this scheme was under discussion there occurred an unprecedented expansion in the population of this part of the Colony. The land population of the peninsula, which in 1891 stood at 20,000, was returned by the census of 1901 as 44,000, and to this had to be added—for purposes of water supply—the floating population and two small towns known as Kowloon City and Sham Shui Po, in the New Territory; so that the population then requiring water amounted to 66,000 as against 44,000 when the scheme was drawn up in 1899. It therefore appeared probable that the original scheme, if carried out, would very soon be out of date. At the same time it was found that a more suitable site for a masonry dam than the site originally selected for the earthen dam existed at a point lower down the stream, and that at this site a dam could be constructed giving a reservoir of 350,000,000 galls. capacity, whilst still giving ample head above the district to be supplied; and this project was eventually selected as the one to be put into operation. The writer in the meantime having left the public service and joined the firm of Messrs. Denison, Ram & Gibbs, his concern was entrusted with the carrying out of the work.

DETAILS OF THE CONSTRUCTION.—This final scheme, which is now fast approaching completion, comprises a storage reservoir to hold 350,000,000 galls. of water; two miles of catchwater channel; three filterbeds, each capable of filtering 500,000 galls. per day; a service reservoir holding 2,000,000 galls.; the necessary connecting pipes of castiron between storage reservoir, filterbeds and service reservoir; and about seven miles of additional mains to extend the present distributing system.

The storage reservoir is formed by a masonry and concrete dam which, when finished, will be about 600′ long on top and 112′ high from the lowest part of the foundation. The mass of the dam is of cement concrete varying in proportion from 1 cement 2 sand 4 broken stone to 1 cement 2½ sand 6 broken stone. The cement used is mostly the Hongkong "Green Island" brand. At the commencement of the work English cement supplied by Messrs. Knight, Bevan & Sturge was used, and at one time a consignment of German "Hermoor" cement was procured. A comparatively low test was demanded and all these cements have given satisfaction. The sand is sea sand obtained from beaches on the neighboring coasts, and the stone is hard igneous rock found in the neighborhood and hand broken. In the mass of concrete stones are bedded averaging about three cubic feet each, no stones being nearer together than 6″.

The water face of the dam is of granite masonry dressed on beds and set in cement mortar, and behind this is a backing of rich concrete, 5′ thick at the bottom and reduced to 2′ thick at the top. The outer face is of rubble masonry set in cement mortar. The dam is of a gravity section and curved on plan, the curvature being introduced to avoid a deep drop in the stream bed and at the same time to take advantage of projecting spurs in the sides of the valley to reduce the length of top-water level.



KOWLOON WATERWORKS.—MASONRY DAM OF THE STORAGE RESERVOIR

The foundation for a length of 400′, and to a level of about 40′ below overflow level is on hard rock, and above this the ends are keyed into decomposed granite. The outlet appliances are contained in a valve tower on the inner face of the dam, and consist of 10″ castiron standpipe with four inlet pipes commanded by 6″ valves and fixed at different levels so that the water will always be drawn from near the surface of the reservoir.

A subsidiary dam about 20′ high, built in a convenient depression, forms the overflow or byewash dam. This is 100′ wide in ten 10′ openings and is designed to pass stormwater at the rate of 4″ per hour from the natural drainage area with 1″ per hour from catchwater area with a head of 4′. The recorded heaviest rainfall in Hongkong occurred in May, 1889, when 11.9″ fell in four hours.

Movable iron sluices are provided on the top of the byewash dam. These are to be let down when the heavy rains have ceased at the end of the summer, and will thus in ordinary seasons impound an extra 2′ of water without raising the water-level to a greater height than it would reach during a heavy rainstorm.

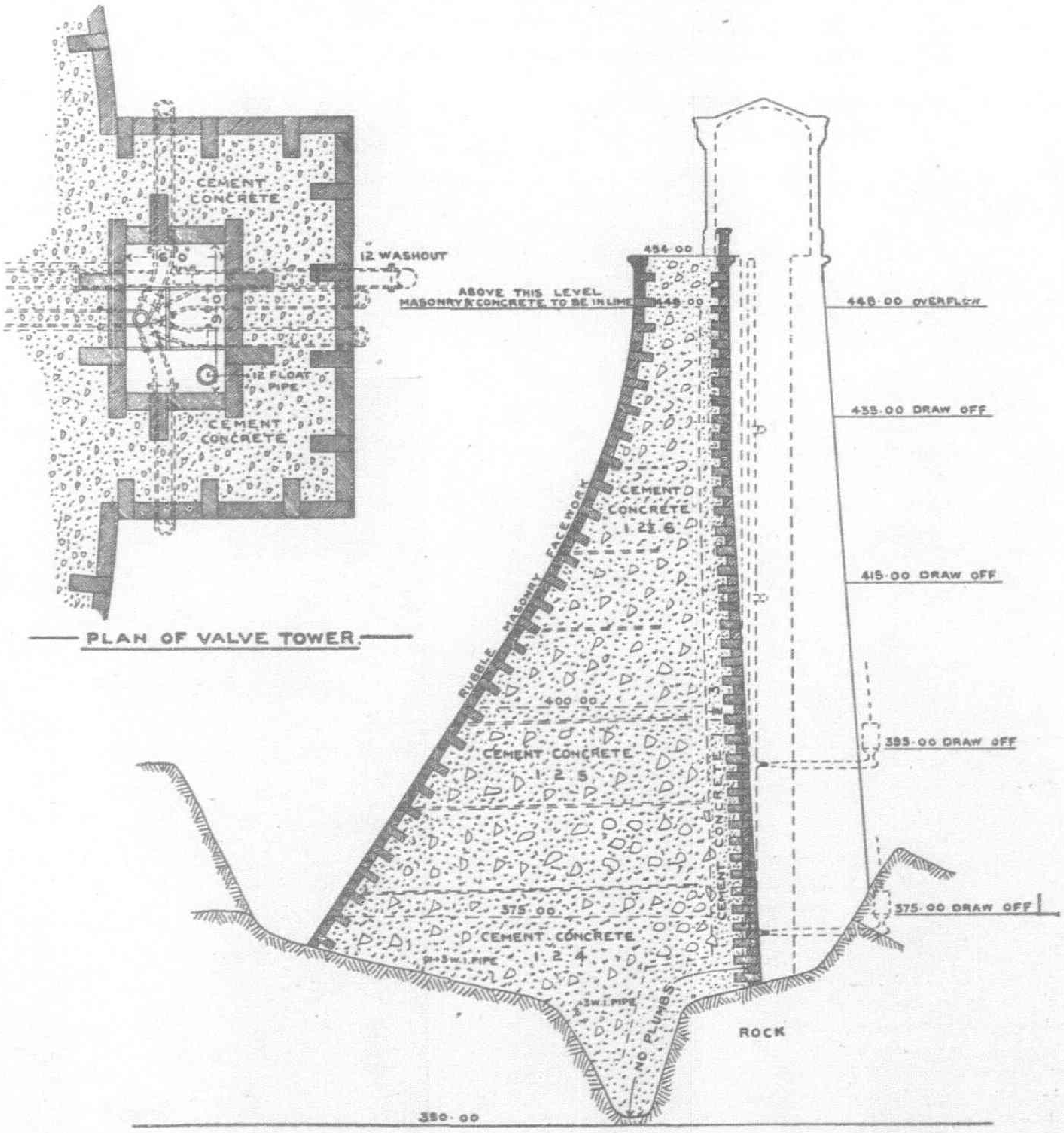
DRAINAGE AND OVERFLOW.—The natural drainage area of the reservoir is only 460 acres. Experience gained with storage reservoirs on Hongkong Island has led to the conclusion that it requires about one square mile of catchment and a storage of about 200,000,000 galls. to provide 1,000,000 galls. a day. It was therefore evident that the drainage area must be increased. For this purpose a catchwater channel was constructed, intercepting the flow from an area of 400 acres. This catchwater is an open channel cut on the hillsides at a gradient of 1 in 2,400 and lined with concrete. In the bottom of the catchwater a small V-shaped channel is constructed to carry the dry-weather flow and prevent its loss by evaporation if spread over a broad surface. It is estimated that the catchwater will carry from ½″ to 1″ of rain per hour from the drainage area of 1,000 acres. Overflows are provided in suitable places, which will come into action when the rainfall exceeds this quantity. At the lower end of the catchwater, the dry-weather flow channel is connected to a small channel, passing round the side of the reservoir, and connecting by means of an 8″ castiron pipe to the gauge basin on the main supply pipe from the reservoir. This is called the *clearwater channel*, its function being to intercept the water from the streams and carry it direct to the filterbeds, as after heavy rains the water in the reservoir will remain for some days so turbid as to be practically unfilterable.

FILTRATION.—From the storage reservoir a 10″ castiron pipe, on a steady gradient, leads to the gauge basin already mentioned. From this gauge basin an 18″ castiron pipe, at a uniform gradient of 1 in 1,000, conveys the water to the filterbeds. These are three in number, each of 800 square yards area, the filtering material consisting of 3′ 6″ of sand on 1′ of broken stone, arranged for downward filtration. Adjustable outlets will be provided to maintain a constant height of water in the beds, and Venturi meters to record both the rate of filtration and the total flow. After leaving the filterbeds the water will pass through a short tunnel in castiron pipes which are continued for about three miles to connect with the old distributing system, passing on the way a Venturi meter which will measure the total supply.

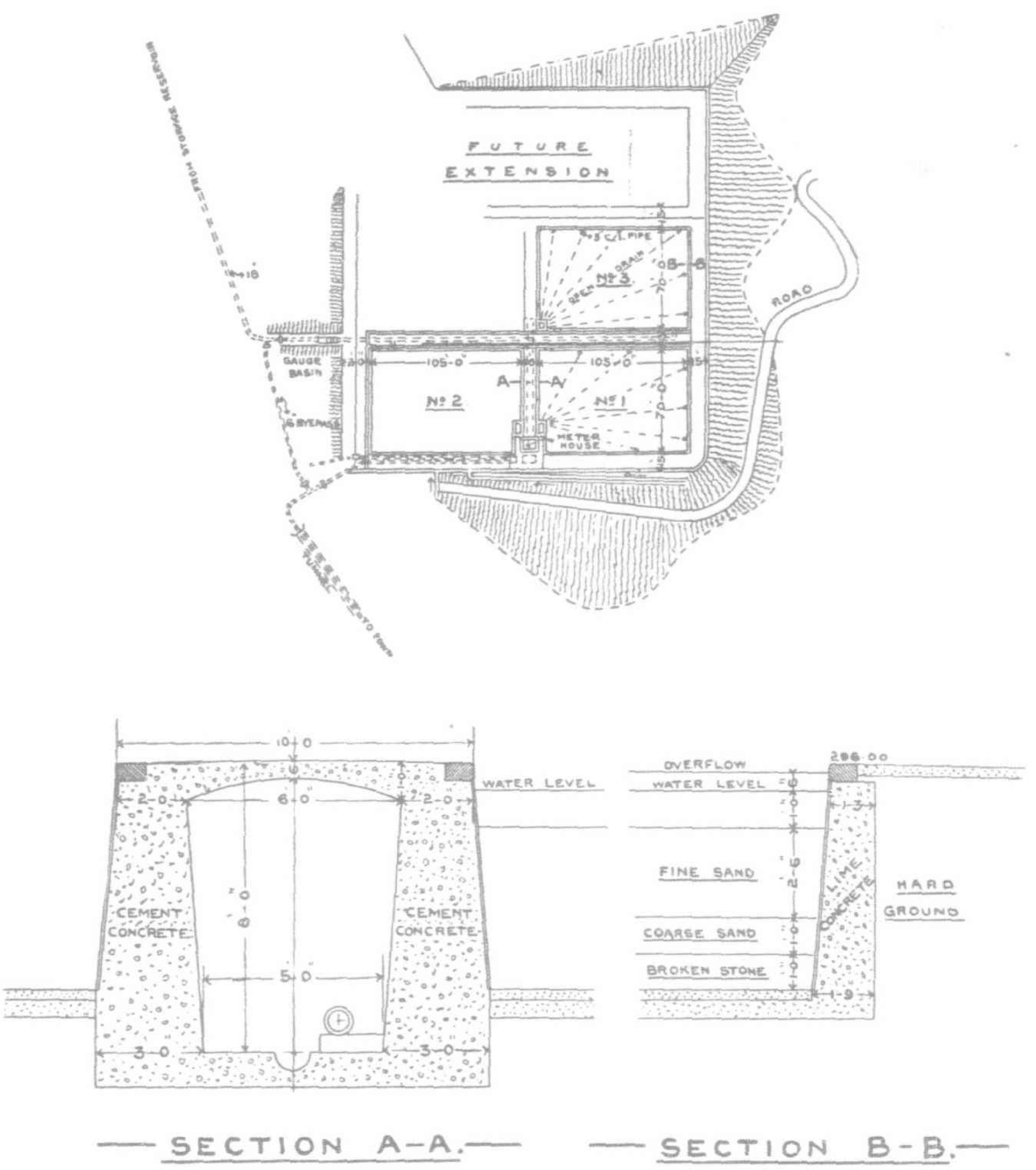
SERVICE RESERVOIR.—The service reservoir is situated on a hill of decomposed granite just beyond the old boundary-line of the British territory, no site at a suitable height being available near the center of the supply district. It is built entirely in cutting, with floor and sidewalls of cement concrete, and vaulting of the same material carried on brick arches and stone pillars. The reservoir is 150′ in diameter and 20′ deep, and has a capacity of 2,000,000 galls., the in and outlet pipe being arranged so that the water flows in at the top and out from the bottom of the reservoir, thus insuring aeration and circulation.

WATER SUPPLY.—The water is supplied in the Chinese quarter by means of self-closing taps, fixed about 100 yards apart at the sides of the streets, all water laid into private premises being charged for by meter. Ball fire hydrants will be fixed about 100 yards apart on all mains in the built area.

SUPPLEMENTARY.—The construction is being done by Chinese contractors from the designs and under the supervision of Messrs. Denison, Ram & Gibbs. Concreting was commenced on the storage reservoir main dam in January, 1904, and the masonry is now within 30′ of overflow level and impounding about 100,000,000 galls. of water. The catchwater is nearly complete, the filterbeds and service reservoir in use, and the extension of the distributing system well in hand. The total cost of the improvement is estimated to amount to $1,200,000 (Mexican currency), and the supply in the driest year to 1,500,000 galls. per day.



KOWLOON WATERWORKS.—MAIN DAM UNDER CONSTRUCTION

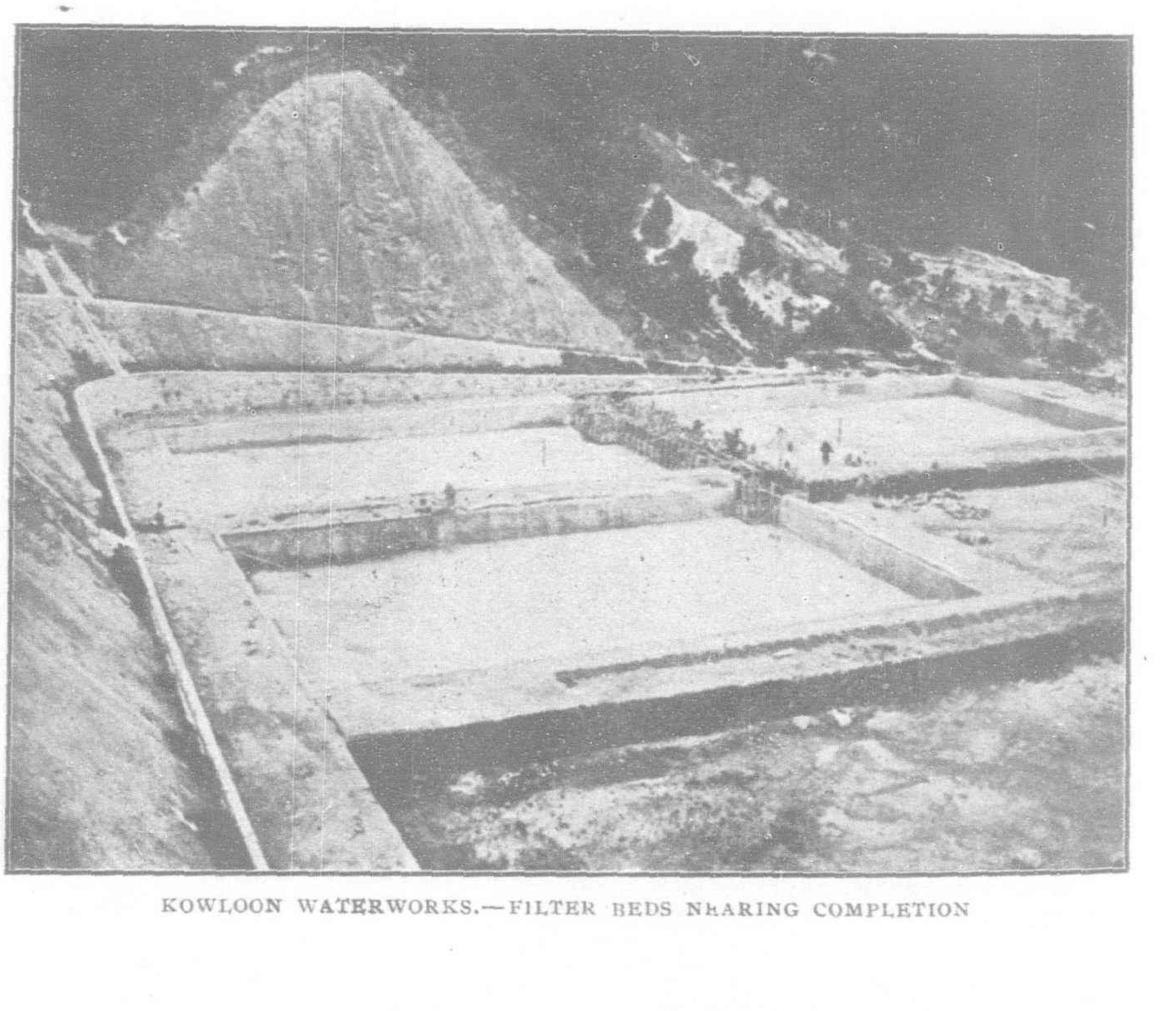


KOWLOON WATERWORKS.—PLAN OF THE FILTER BEDS

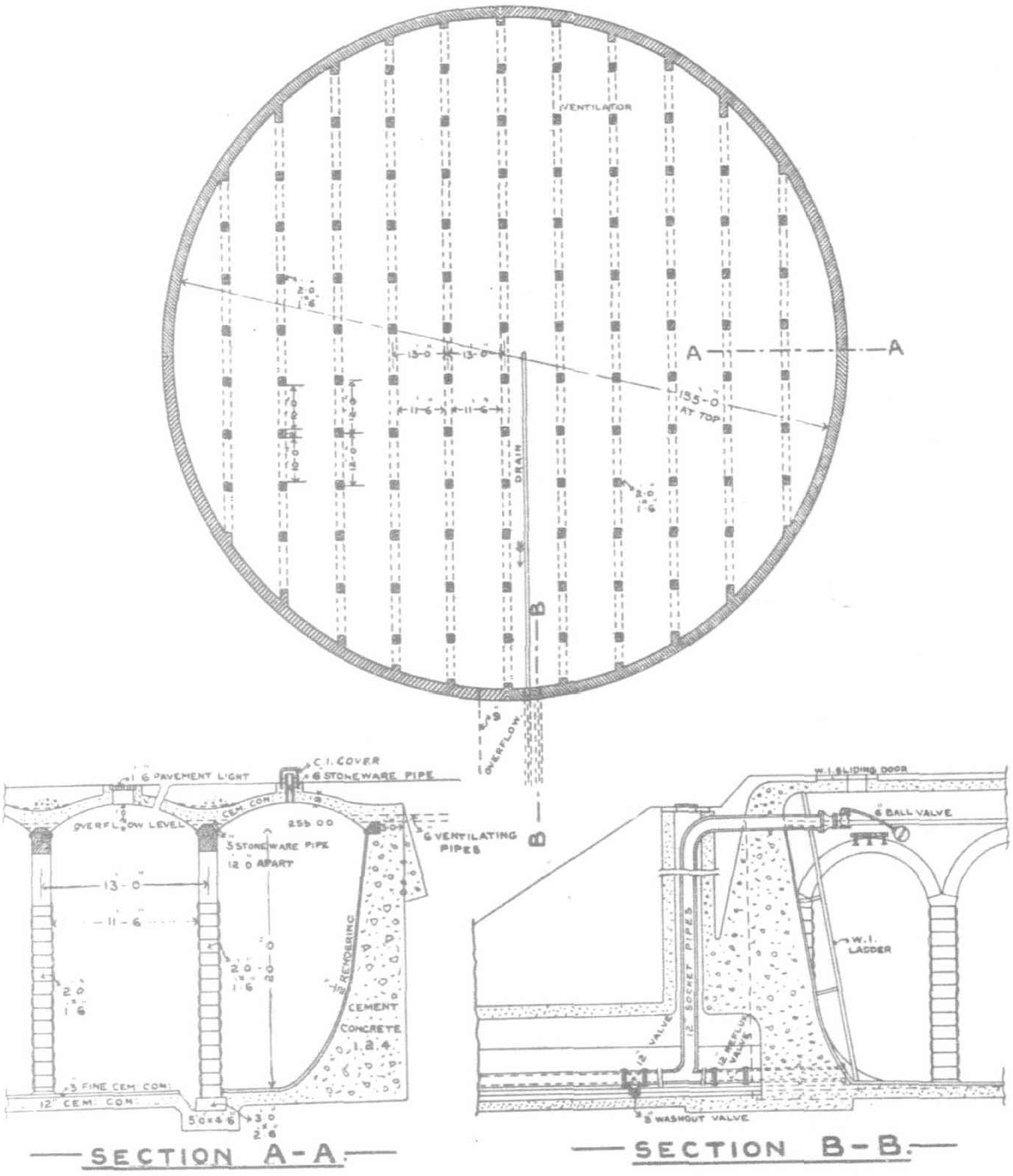
GREEN ISLAND CEMENT COMPANY, LTD., HONGKONG

The 18th ordinary general meeting of the shareholders in the Green Island Cement Company, Ltd., was held recently at the offices of the general-managers, Messrs. Shewan, Tomes & Co., of that city. There were present Mr. R. Shewan (in the chair), Hon. Mr. W. J. Gresson, Dr. J. W. Noble, Sir Paul Chater, consulting committee; Captain W. E. Clarke, and Messrs. R. Hancock, F. Ellis, A. H. M. Silva, and R. Henderson, secretary.

Chairman's Address.—The address of Mr. Shewan was as follows:—"The report and accounts for 1906 were issued to you on February 18th, and as I presume you are all quite familiar with their contents, I will not read them now, unless you desire me to do so. Our working account shows a slightly higher profit, but the amount for division is less owing principally to the fact that 1905 commenced with a balance at credit of profit and loss of some $95,000, brought forward from 1904, while 1906 began with only $52,000. The final result, however, is that we are able to pay $368,500 away in dividends this year as against a total dividend and bonus last year of $375,000, not a very great difference. As ample provision has been made for depreciation we only propose to place a nominal sum to reserve fund which being invested in our business is really additional capital, and not actual funds kept in reserve as it should be. The result of the year's work is, I trust, satisfactory to shareholders, but it would undoubtedly have been worse owing to the course of exchange which enabled cement makers at home to offer their brands out here at lower silver prices which we, of course, were forced to accept or lose the business, had it not been for our increased output which affects this reduction in prices. In other words, we did a larger business to make up for lower prices. As for the future, although I do not care to indulge in prophecy, I can say that this year has begun well, and that our present prospects are very good, if exchange does not hit us any harder. The consumption of cement, as every engineer will tell you, has increased, is increasing, and will increase. The use of reinforced cement concrete is growing rapidly all ovr the world, and should be especially in favour out here where our buildings are so subject to the attacks of white ants, dry rot, etc. The rotary kilns which we added last year took longer than we anticipated to get into thorough working order, but they are causing little trouble now and their outturn is giving us the greatest satisfaction. In fact they have produced so much more than was anticipated that to enable the grinding plant to keep up with them we had to order additional mills. These with the new boiler house extension and new saw mill building principally account for the expenditure of $166,000, at Hok Un, where, as I told you last year, we did not expect to spend more money. Another lakh has been spent at Macao, but it has been well spent on economies from which we are making an excellent saving in working expenses. As you are all aware a cement plant which was intended for erection in Manchuria, but which had been landed here during the war, was offered for sale at auction in June last, and as it was for obvious reasons desirable that this plant, which, however, was far from complete, should not get into other hands, we decided to acquire it for this company. It is now in course of erection, and will, when completed, add two more rotaries to the present two, just doubling the output of our rotaries. We shall not, of course, commence running this plant until circumstances require it, but if the consumption of cement continue to grow, as it has done in the last year or two, it should not be standing idle long, and in the meantime the loss of interest is not very serious. This, with the expenditure I have mentioned at Hok Un and Macao and about $47,000 at Deep Water Bay, where we have added a large pipe machine, accounts for nearly $600,000. In addition to this we had on 31st December $136,000 more than last year owing by sundry debtors, $50,000 more spent on launches and lighters, mostly for cost of two new lighters, and about $240,000 more in stocks of cement and raw material on hand equal to $426,000, making a total expenditure of over $1,000,000. Our stock of cement is large,but not too large for our purposes, as new cement takes a long time to mature, and thus we are compelled to carry large quantities in stock. We cannot, as you quite understand, afford to allow green cement to go out of the factory. In this way the $500,000 we received from you for new capital and the increase of nearly six lakhs in the over draft at the bank is accounted for. The payment of the dividend will increase the latter by $250,000, and this brings me to the old question of more funds, for we cannot go on doing a bigger and a bigger business without more and more capital, and we cannot always depend on borrowing money from our bankers. We require roughly $1,100,000 to make us comfortable, and to get this we propose to issue 200,000 shares to share-



KOWLOON WATERWORKS.—FILTER BEDS NEARING COMPLETION



KOWLOON WATERWORKS.—PLAN OF THE SERVICR RESERVOIR

holders, one new for one old, calling up on each $5.50 in one payment in July next, and to raise these shares to $10, paid up, we propose crediting a call of $4.50 on them, which will absorb $900,000, out of the reserve fund, which will then be reduced to $11,000. I hope I have made it clear to you that this proposal means that shareholders will only be asked to provide $5.50 per share in cash, the $4.50 being given them from the reserve fund, and I trust that this plan which, of course, will be brought before shareholders in the usual way at an extraordinary meeting later on will commend itself to you. This would raise the capital to $4,000,000, but I must again remind those who think that another similar factory could be started at once and run for the same capital that this does not by any means represent all that was, I will not say lost, but consumed at the outset in making experiments and gaining experience and all of which was written off *en bloc* when the company at last began to get on its legs. It is an experience which every new factory must expect to encounter, and which it will have to take into account and to pay for out of capital and had we not dealt with it in the beginning, our own capital would have been very much larger. I would also suggest that the fee for the consulting committee, which has stood at the low figure of $1,500, since the beginning, should now be raised to a figure more commensurate with the increased business we are doing, say to [illegible],000 per annum. I think I have now laid as full a statement of what we have been doing during the past year as I can, without going too deeply into details, but I shall be glad to amplify [illegible] if any shareholder is not clear on any point. I must add, before I sit down, that the erection and construction of so much new plant and machinery has thrust a great deal of extra work on Mr. Uldall, the manager, and Mr. Hewitt, the engineer in charge, at Hok Un, and that we are much indebted to them for the cheerfulness with which they have given up their spare time and the readiness of resource with which they have met all difficulties inseparable to new work with unskilled labour, in all of which they have been well supported by the manager at Macao, Mr. Hoyes, and the staffs at both places.

There were no questions asked.

The chairman proposed the adoption of the report and accounts.

Dr. J. W. Noble seconded.

Carried.

Mr. R. Hancock proposed that Sir Paul Chater, Hon. Mr. W. J. Gresson and Dr. J. W. Noble be re-elected to the consulting committee.

Mr. F. Ellis seconded.

Carried unanimously.

Captain W. E. Clarke proposed that Messrs. W. H. Potts and A. O'D. Gourdin be re-elected auditors for the coming year.

Carried *nem con.*

The Chairman—That is all the business, gentlemen. Dividend warrants are ready now.

The meeting then ended.

FAR EASTERN NOTES

Space at the Japanese managed commercial exhibition at Mukden, Manchuria, is available to American manufacturers and exporters.

The first official report on the 1906-07 rice crop of British India gives the acreage in the provinces reporting, representing about 38 per cent. of the total area planted to rice in that country, as 50,900,200 acres, against 51,058,500 acres reported for the same provinces in 1905-06.

Every effort possible is being made to use native woods for ties in building the railways in the Philippines.

Loans are freely made by the Philippine Commission to the various provinces for the erection of public buildings in the islands.

A Japanese shoe manufacturing concern has secured a contract for shoes for the British army in India. It is one of the largest shoe contracts ever placed.

Formosa's foreign trade amounts to nearly $25,000,000 gold yearly, and is increasing at the rate of 10 per cent. a year.

The Tokio Electric Company, with financial and other assistance from the General Electric Company of Schenectady, N. Y., is manufacturing electric supplies for sale in Japan and over the Far East.

Instead of exporting its zinc ore, as formerly, Japan will smelt it and sell the product in the markets of China and Corea.

American and German locomotives have outclassed British locomotives as to sales in Japan.

Western Australia is buying mining pumps freely.

Japan's tobacco harvest is large. The Government profit will be 32,000,000 yen ($16,000,000).

Borneo tobacco sold this year in the United States for the first time.

The floating dock of the German colony at Tsingtau, China, is capable of caring for vessels, of 16,000 tons capacity. All the appliances are modern.

KOWLOON WATERWORKS.—CATCHWATER CUTTING UNDER CONSTRUCTION

MACHINERY IN INDIA

India as a buyer of machinery has peculiarities and limitations, yet the purchases are increasing and the market once secured is permanent. In seeking to supply it, the distinguishing characteristics of the native population must always be borne in mind. The manufacturing industries of the country are few, and outside of the cotton and jute mills factories are not numerous; but there are a vast number of hand industries which require certain types of machines. The requisites for supplying them are simplicity and comparative cheapness. Novelty is a drawback. The Hindu is as conservative in his methods of labor as in his religion. He prefers the patterns and designs which his fathers have used, and while he can be got to accept innovations when their greater utility is demonstrated, this only can be done by conforming outwardly as far as possible to the models to which he has been accustomed.

Allowing for the persistency of habit, importers of machinery say that the native workers show excellent mechanical capacity, provided the machines which they are put to operate are not too complicated. Their hands are deft and their feet also. But the excessive cheapness of coolie labor always has to be borne in mind, and also the low wages, which, in the mechanical pursuits, are a little above agriculture. When 25 cents a day represent the earnings of an artisan, neither high efficiency in production nor marked mechanical skill can be expected. Nor, outside of the cotton mills, are manufacturing plants with large capital to be looked for. In many industries an investment of 100,000 rupees, or $32,000 gold, is the limit; but it must be understood that, as measured by prevailing economic conditions, $32,000 in India stands for as much as $100,000 in the United States. Yet the best market is not to be found in plants of this character, but rather in the infinitely larger number of small shops where an investment of from $500 to $2,500 supplies the necessary outfit. Some of these are practically cottage industries. A dozen streets in Bombay are given up to them, and a day or two spent in these crowded quarters shows how the multitude of the small shops which exist for every possible purpose from repairing an automobile to drilling a hole, in a copper plate, in the aggregate make the demand for machinery an important one.

The United States has inserted the thin edge of the wedge into this trade and American manufacturers may find encouragement from the admission of some of the ultra conservative British houses that they are at a disadvantave in competing with the machine tools of the United States. In several lines of metal-working machinery they would be compelled to depend on their American competitors if sufficient enterprise were shown by the latter in cultivating the Indian trade. As it now is the direct imports of this class of machinery are not large, though a fair quantity is transshipped in England from consignments made without the American exporters knowing the destination. But these transshipments are usually only to fill out where the British manufacturer is unable to supply what is wanted, and are a hindrance rather than a help to American articles.

Among the manufacturers for which a permanent and reliable market now exists in Bombay are small forges, lathes, drilling, planing, punching, shearing, and similar tools that can be operated by hand or foot. The use of lathes operated by foot power and of drills is increasing, and the American manufacturers would add to their sales if they paid more attention to providing their products with bed gaps so that the machines could be fastened to the bench. Most of those now forwarded are for fastening to the post or wall, but the Hindu wants them attached to the bench, since that conforms better to his manner of working.

Some small steam drills have been imported from the United States and have given satisfaction; but, for the reasons already stated, the larger sale is for the hand drills. The great body of the consumers are not able to provide themselves with steam power. In all kinds of metal-working machinery intended for India the American manufacturers should consider solidity rather than lightness of finish or novelties in the way of improvements.

For generations the only pattern known to the Hindu has been of the heavy British type, and while he is not averse to availing himself of improvements, as is shown by the market that has arisen for the American metal-working tools, he takes most kindly to those which are of the solidest pattern. So long as increased efficiency can be demonstrated, it is better not to insist on offering him the further advantages of finish and what the British importers of machinery call "Yankee gimcracks." It may be added that a technical physical demonstration is all that counts with the Indian buyer. Illustrations, descriptions, and the fluency of the most persuasive salesman go for nothing unless all that is claimed can be shown before his eyes. A working model is essential.

The United States is now sending each year to India by direct shipment about $50,000 gold worth of pumps and pumping machinery, most of which is imported through Bombay. Hand pumps command the largest sale, and a firm at Salem, Ohio, is the leader in the trade. These hand pumps answer the native needs in every respect Some American steam pumps are also imported, and the best market for these is for general service ones. The large number of bungalows or villa residences which form a feature of the life of the well-to-do classes, both European and native, and which require a complete plant for their own use, afford a constant market for pumps of all kinds. Windmills in some sections of the country have a good sale. The demand for triplex-power irrigating pumps is a good one. The gearing should be about one-half higher than for the same pump in the United States because the bullocks and water buffaloes, which in India take the place of the horse, move at a very slow gait.

There is an opening for small hand presses in India. What is known as the Anglo-Indian press—that is the newspaper and other publications in English—has some very fine modern plants with the latest improvements in American presses. But these orders are given through London, and the trade is not one that offers new prospects. The real opportunity is in supplying the native or vernacular press both for newspaper and for job purposes. The number of daily and other journals published in the vernacular is astonishing. At Lahore, in Northern India, which is the capital of the Punjab, there are 14 or 15 daily papers.

The difficulty in casting type for the vernacular languages of India is not insurmountable. While the Urdu, or proper Hindustani, has to be written by professional copyists with reed pens on specially prepared paper and then lithographed on stone and printed in this manner without type, the Hindi offshoot from Sanscrit can be produced from type, as can the various vernacular languages cognate to the original Sanscrit. The Marathi, which is used in parts of the Bombay District, Gujrati, Punjabi, Bengali, Tamil (which is the prevailing tongue in southern India), and other forms of the popular speech in different regions, all differ from Hindustani in that they can be printed from type. Several typefounders who supply the missionary publication houses with the Bible in foreign tongues, of which copies in forty languages and dialects are distributed in Bombay, have adaptations of the Sanscrit characters suitable for most of the printed languages of India. The supposed lack of suitable type does not therefore retard the progress of the printing industry. For reasons not necessary to enter into here the publication of newspapers, pamphlets, and small books in the vernacular languages is certain to go on increasing, and thus to create a demand for presses and the other accessories of printing The point for the manufacturer to know is that, as in other industries of India, the capital available for a plant is not large, and expensive presses are out of the question.

An excellent market for typewriting machines has been established, and is of course controlled by the American manufacturers. Most of the leading machines are represented by local agencies, and the competition among them is very keen. A newcomer into the field would find that no necessity existed for educating the public concerning the advantages of typewriters; but in undertaking to demonstrate the superiority of his own machine he would discover that the ground already had been well covered. Nevertheless, the demand is so constant that a new type of machine, or one new to Bombay, might establish a market if it could demonstrate its superiority in any important particular. The chief native importing and commercial houses generally conduct their correspondence in English and make use of the typewriter for this purpose, as do also the cotton factories.

Cash registers have been slow in coming into favor, and at the present time not more than a dozen are in use in all Bombay, but their introduction at last having been obtained they appear likely to command a fair sale, both the simple and the multiplex register.

The demand for sewing machines is a steady one, but to command a large sale they must come within the means of the great body of consumers and therefore be cheap. For this reason Germany is a strong competitor with Great Britain and sends one-third as many machines as the latter country, though their value is far below one-third the value of the English importations The total number of sewing machines imported into Western India during the last fiscal year was as follows:—From Great Britain, 5,991; Germany, 2,175; Belgium, 653; United States, 472. Both the Singer and the Wheeler and Wilson companies have Bombay agencies, but the Singer machines are those from the factory in England and their sale does not add to the United States trade.

Electrical installation in Bombay has just begun. Several years ago the Boston capitalists who owned the tramway system proposed the change from horses to electric traction and to provide power for a variety of purposes. A local English official who was strangely opposed to American enterprise succeeded in blocking an agreement with the municipality which would have enabled this to be done. Finally the Americans closed out their interests and the work was undertaken by a British company, which after several years is just getting into shape to supply power. At present not more than 200 electric fans are in use in Bombay, but their number will be largely increased. The business of supplying hotels, bungalows, etc., with small electric plants appears to be in the initial stage.

A proportion of the Indian wheat crop is ground into flour for home consumption. The flour mills are located chiefly in Northern India, which is the grain-growing section of the country. The supremacy of American manufacturers in flour-mill machinery should give them an opening in supplying Indian mills. But, as in every other industry, the limited capital must be understood, and the modest plants not be confused with the great mills of Minneapolis or Rochester.

There is good opening for sawmill machinery, but here too the plants wanted are small ones. A sawmill for India delivered at the dock in New York, free on board, for $300 gold does not appear to indicate a wide market, yet it is the aggregate of these small plants that counts, and the best sale is for plants which can be thus delivered at $300 to $500 gold. The freight and other charges bring the price in India up 10 to 15 per cent. The chief wood of India, which is used for every purpose from hand carving to furniture and house building, is teak wood. This is very hard and heavy, almost equal to iron wood or lignum vitae. It turns the inserted teeth of an ordinary circular saw as if they were tin. Sawmill machinery for India should therefore be made so as to meet this difficulty.

Textile machinery is so largely a monopoly of Great Britain that it can not be said India offers a field in which other manufacturers could compete on even terms. The short staple, very coarse, Indian cotton affords little similarity to the long-staple product of the United States, for which the American manufacturers have been accustomed to provide machinery. Should what is known as the Spence cotton tree work the revolution in Indian production which is promised for it and demonstrate that an indigenous staple superior to that of the United States exists, new machinery suitable to the long staple would be necessary and the experience of the American manufacturers might enable them to compete with the English. But though very flattering reports of the Spence cotton tree are given and its cultivation is being extended, no great change in the machinery supplied to India in order to gin, spin, and weave the new product is likely in the immediate future. The prosperity of the cotton industry during the last two years has caused the erection of many new mills and the remodeling of old ones, so that India is becoming supplied with the latest improved machinery.

While there does not appear to be much of an opening for American installation of textile machinery, there is a good market for accessories, or what the British call mill stores. Small stationary steam engines for the ginning factories are in demand, and a salesman by means of illustration occasionally might be able to sell a large compound engine. The Indian boiler act is very strict in its requirements and differs essentially from the tests which are imposed in Great Britain or the United States, so that its provisions should be carefully studied.

In steel shaftings, split pulleys, etc., the American manufacturers have been quite successful in satisfying the requirements of the Indian mills and they also have been able to meet the prices quoted by the British manufacturers so that a good trade has been obtained. In belting, however, concessions both as to price and as to methods will be necessary if a foothold is to be obtained and maintained. The Indian market requires that the belting be sold by the pound instead of by running feet, as is done in the United States. The English price is considerably below the American one, and it is claimed that a 300-foot roll bought by pound weight in England, totals one-half less than when bought in the United States. With this discrepancy there is not much chance of extending the American trade until belting is offered by weight, and prices shaded to the English basis.

CHINA AND MANILA STEAMSHIP COMPANY, LTD.

The report of the directors of this company, presented at the 24th ordinary general meeting, held in the office of the general-managers, Messrs. Shewan, Tomes & Co., at Hongkong, recently, is as follows:—

Annexed we beg to submit to shareholders the usual annual statement of accounts for the year ending 31st December, 1906.

The net profit is $27,365.57 which it is proposed to appropriate as follows, viz:—

To place to Reserve Fund	$1,000.00
To pay a dividend of$1 per share	26,000.00
To carry forward to the credit of next year's account	365.57

The S. S. *Rubi* and *Zafiro* ran regularly and very satisfactorily throughout the year, but both passengers and cargo were much scarcer than before. Our gross income shows a very heavy falling off and it has only been by exercising the strictest economy and cutting down expenses that we are able to show a surplus.

CONSULTING COMMITTEE.—Mr. D. E. Brown resigned on leaving the Colony, and Dr. J. W. Noble was invited to take his place on the Consulting Committee. In accordance with the articles of association Messrs. N. A. Siebs, H. P. White, A. V. Apcar and Dr. J. W. Noble retire but offer themselves for re-election.

AUDITORS.—The accounts have been audited by Messrs. W. H. Potts and A. O'D. Gourdin, the latter having been asked to fill the vacancy caused by the death of Mr. T. Arnold. Messrs. W. H. Potts and A. O'D. Gourdin are recommended for re-election.

SHEWAN, TOMES & Co.,
General Managers.

PROFIT AND LOSS ACCOUNT.

Consulting committee's fees	$2,250.00
Auditors' fees	400.00
Interest	9,835.03
Charges	668.78
Amount written off as depreciation for 1906	41,027.37
Balance	27,365.57
	$81,546.75
Balance brought forward from 1905	$6,563.45
Exchange	8.88
Profit on working account s. s. *Rubi* and *Zafiro*	74,974.42
	$81,546.75

BALANCE.

Liabilities.

Authorized Capital 30,000 shares @ $25 each	$750,000.00	
Issued and fully paid 26,000 shares @ $25 each		$650,000.00
Calls on shares forfeited now belonging to the Company		160.00
Reserve Fund		6,000.00
Underwriting Account		30,976.29
Sundry creditors		28,235.04
Company's Bankers		132,998.60
Balance of profit and loss account		27,365.57
		$875,735.50

Assets.

Value of steamers *Rubi* & *Zafiro*	790,000.00	
Less depreciation	40,000.00	
		$750,000.00
Value of Hongkong buoy and mooring	2,029.85	
Less depreciation	129.85	
		1,900.00
Value of Manila buoy and mooring	6,300.46	
Less depreciation	400.46	
		5,900.00
Value of Amoy buoy and mooring	2,258.50	
Less depreciation	158.50	
		2,100.00
Value of stores on hand	3,738.56	
Less depreciation	338.56	
		3,400.00
Value of coal on hand		4,037.50
Proportion of premium on current policies		24,864.03
Sundry debtors		36,840.74
Outstanding freights 1906		44,430.30
Cash		2,262.93
		$875,735.50

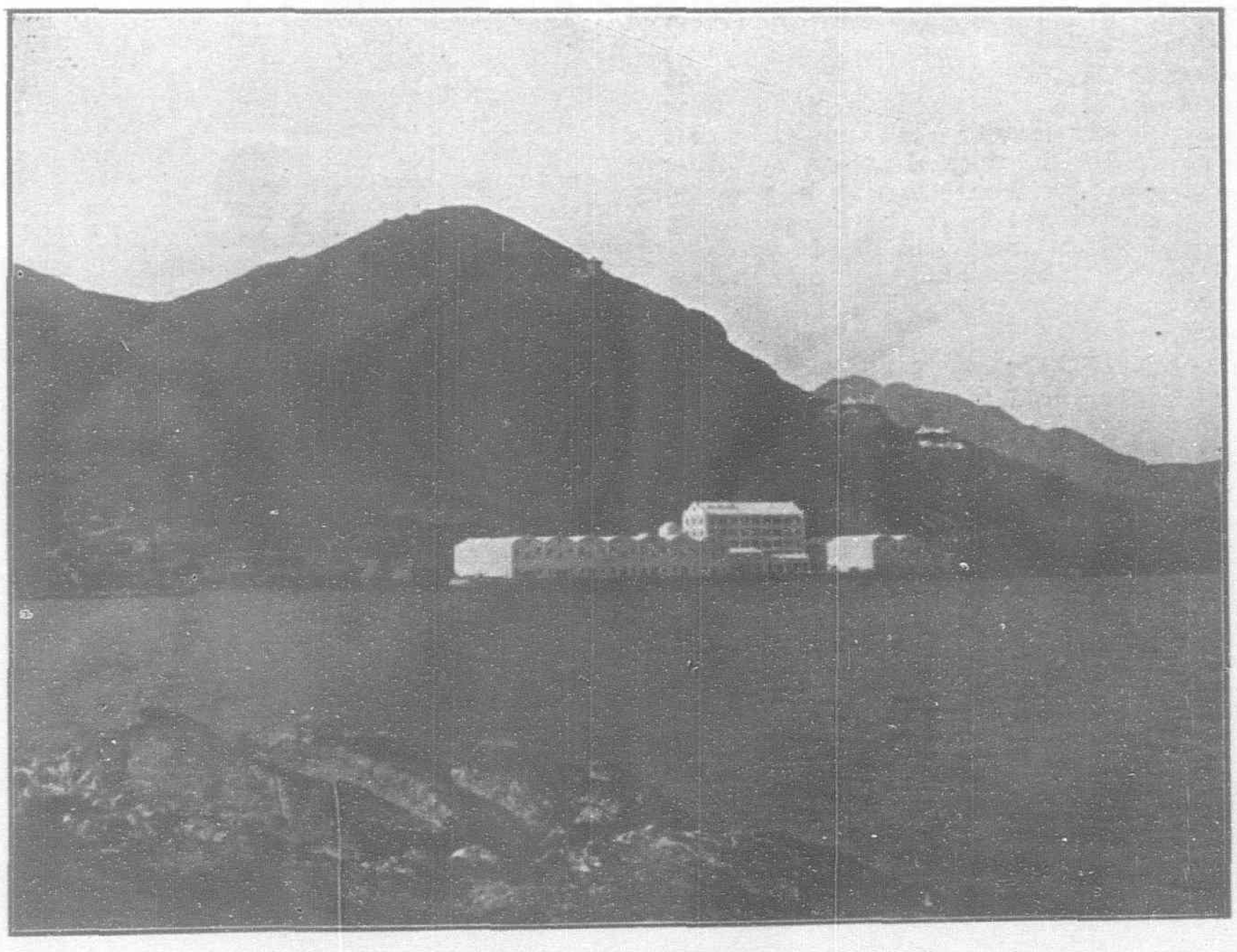
PLANT OF THE HONGKONG MILLING COMPANY, LTD.

The flour mills recently completed at Junk Bay, Hongkong, by the Hongkong Milling Company, Ltd., have been in operation since the first day of the current year. These mills are the first of their kind in South China. They are equipped with the very latest and most improved machinery known to the scientific world for the grinding of flour and have acapacity of 8,000 bags of the product per day. They are conveniently located on the foreshore of Hongkong Harbor for shipping purposes and as they have practically the whole of China as a market for their product the industry seems to have been inaugurated under most favorable conditions. If business comes up to the expectations of the promoters they intend to double the capacity of their manufactory at the end of a year.

An accompanying illustration gives a very good general idea of the mills. The wheat godowns, with a capacity for 1,000,000 bushels of grain, are on the left of the milling building. They were specially constructed to keep the wheat in good order and protect it against the effects of the climate. The flour godowns stand at the left of the main building, and they, too, are a model of what such constructions ought to be. The sloped-roof building abutting on the flour godowns is the bran store, and the buildings to the right on the hillside are the employés' residences, while the engineroom and repair shops are the low buildings directly in front of the mills. The sheds in the extreme right of the picture are the pigsties.

The entire plant is replete with improvements and time-saving inventions. Among the latter is a wire rope and basket arrangement for carrying the bags of wheat from a ship lying off the mills. The most modern motive power is used in the milling operations. Electric fans blow the bran from the mills to the pigsties, a distance of 3,000′, and liquid fuel is fed to engines from a tank on the hillside.

The prime mover in this enterprise is Mr. A. H. Rennie, of Hongkong, whose large experience in the business eminently fits him for the successful conduct of the new company's affairs. Associated with him in the enterprise are Sir Paul Chater and Mr. H. N. Mody. The mills were designed by the well-known architects, Messrs. Leigh and Orange, and their construction were under the supervision of Mr. James Orange, the junior member of the firm.



NEW FLOUR MILLS AT JUNK BAY, HONGKONG

DETAILS AND DESCRIPTION OF THE BURNHAM PLANS FOR THE RC ONSTRUCTION OF MANILA

All municipal works under way in Manila at the present time are based as nearly as practicable on the recommendations and plans submitted to the Government, for the future urban development of the city, by Mr. H. H. Burnham, the famous American architect, and now stamped with the approval of the Secretary of War. Mr. Burnham visited Manila in 1905 and made a study of existing conditions. This was when the great movement for making cities beautiful along scientific lines was at its height in America. This movement practically began in Washington in 1901, and in time spread to Harrisburg, Pa., Cleveland, O., Buffalo, N. Y., Ottawa, Ont., St. Louis, Mo., New York City, Detroit, Mich., San Francisco, Colorado Springs, Col., Denver, Col., Honolulu, T. H., Oakland, Cal., St. Paul, Minn., Pittsburgh, Pa., Hartford, Conn., Toronto, Can., Indianapolis, Ind., Springfield, Mass., Springfield, Ill., Helena, Mont., Red Wing, Minn., Portland, Me., and Portland, Ore., and numerous other cities of lesser importance. About the time that Mr. Burnham came to Manila, Mr. Charles Mulford Robinson, another noted architect, was invited to Honolulu on what seemed a preposterous errand, as the architect himself puts it, of planning for the greater beauty of that capital. It turned out that in spite of Honolulu's lovely natural advantages, many pertinent suggestions could be made; and that a student of these matters, coming to the Hawaiian Island as a stranger, was able to point out some simple ways of securing attractive effects that the residents had never thought of. As in the case of Manila, Mr. Robinson's recommendations regarding Honolulu are being carried out.

Mr. Burnham was well qualified to plan for the beautification of Greater Manila. He had been the leading spirit in the architectural design and construction of the World's Fair at Chicago, and later was chairman of the commission chosen by the District of Columbia for the beautification of Washington. He had been called into consultation with other committees on civic improvements, so when he came to Manila it was with a fund of the latest ideas developed by the master minds of experts in America, in addition to his own large knowledge.

MR. BURNHAM'S REPORT.—Years may pass ere Mr. Burnham's plan for Greater Manila is fully realized, but once the transformation is complete it is safe to predict that this oriental port will stand out as a model of modern municipal greatness. Although the architect's report was submitted to the Secretary of War in the latter part of the year in which he made his investigations here, his conclusions were not made public in their entirety until about six months ago, when the report and plans were published by the Bureau of Insular Affairs at Washington, under authority from the War Department. It is altogether probable that some features of the original project will have to be modified from time to time as the development progresses, but it is the desire of the Washington Government and the duty of the Municipal Board of Manila to adhere to the Burnham scheme as closely as possible. The report is as follows:—

Historical.—The City of Manila was founded by Miguel López de Legaspi in 1571 and declared capital of the archipelago. After suffering various vicissitudes, including insurrections and attacks by Chinese pirates, the city undertook, in 1590, extensive fortifications, of which part are still standing. An attack by the Dutch in 1602 was successfully beaten off, but the city finally succumbed in 1762 to the English, who occupied the place until the treaty of 1764, by the terms of which the Islands returned to the Spanish crown. The history of Manila is uneventful from 1764 to 1896, the date of an insurrection that cost the lives of many prominent Filipinos, including Dr. José Rizal. This insurrection was still smouldering when Dewey's guns announced the downfall of Spanish sovereignty.

Present conditions, political.—Given over to civil authority in 1901, Manila is governed by a Municipal Board under the authority of the Governor-General and his fellow commissioners, constituting the Government of the Philippine Islands.

Topographical.—Manila lies almost wholly on level ground, the surface of which is only a few feet above mean high tide. From the lake known as Laguna de Bay, the Pasig River winds through the city to the sea, forming, in conjunction with the small drainage streams or *esteros* emptying into it, a group of important waterways on which much freight of the city is moved from place to place.

Building methods.—Most of the existing buildings were erected in Spanish times and are of a distinctly Spanish type. They were for the most part built of wood with projecting second stories; and their screen windows were built of translucent shells set in mesh grille. The roof, which still further overhangs the building, was commonly covered with beautiful dull red tile, and the effect of the whole is unusually pleasing. At the present time corrugated galvanized iron roofs are taking the place of the beautiful Spanish tile, to the serious detriment of the city's appearance. The old Spanish churches and the old Spanish Government buildings are especially interesting, and in view of their beauty and practical suitability to local conditions could be profitably taken as examples of future structures. The general effect of the existing well-shaded narrow streets is picturesque and should be maintained.

Population.—The present population of Manila is given in the report of the Municipal Board for 1903 as 223,029. Owing to the probable active development of industry and agriculture in the near future, the population of Manila may be expected to increase rapidly, and the introduction of surface transportation will ultimately scatter this enlarging population over a greater territory than that inclosed by the present city limits. For the purpose of this report, however, no reference will be made to the territory outside those limits except in connection with parks and parkways, summer resorts and country clubs.

Aim of the proposed plan.—The aim of the proposed plan is to provide:—

Development of waterfront and location of parks and parkways so as to give proper means of recreation to every quarter of the city.

The street system securing direct and easy communication from every part of the city to every other part.

Location of building sites for various activities.

Development of waterways for transportation.

Summer resorts.

DEVELOPMENT OF WATERFRONT, PARKS, AND PARKWAYS.—Manila, like most other towns at certain seasons, is subjected to protracted periods of heat, during which all exertion is accomplished at excessive cost of physical strength. Although these climatic conditions are unchangeable, means of mitigating their effect are unfortunately within reach. Besides the possibility of abundant foliage and fountains of water, Manila possesses the greatest resources for recreation and refreshment in its river and ocean bay. Whatever portions of either have been given up to private use should be reclaimed where possible, and such portions as are still under public control should be developed and forever maintained for the use and enjoyment of the people. The bayfront, from the present Luneta southward, should have a continuous parkway extending in the course of time all the way to Cavite, as shown on the accompanying plan. This boulevard, about 250′ in width, with roadways, tramways, bridlepath, rich plantations, and broad sidewalks, should be available for all classes of people in all sorts of conveyances, and so well shaded with palms, bamboo, and mangoes as to furnish protection from the elements at all times. In order to make the boulevard presentable and useful as soon as possible, a quick-growing tree like the acacia might be planted, alternating with the trees of slower growth, and be replaced after the latter retain their growth. The boulevard's seaward side should be planted so as to interrupt occasionally the view of the sea and, by thus adding somewhat of mystery, enhance the value of the stretch of ocean and sky. The boulevard is on made ground about as far south as the Old Fort San Antonio, beyond which it strikes the beach and follows the shore line to Cavite. The possible extension of the ocean boulevard along the north shore will naturally depend upon the development of the town in that direction and upon the question of additional harbor works north of the Pasig.

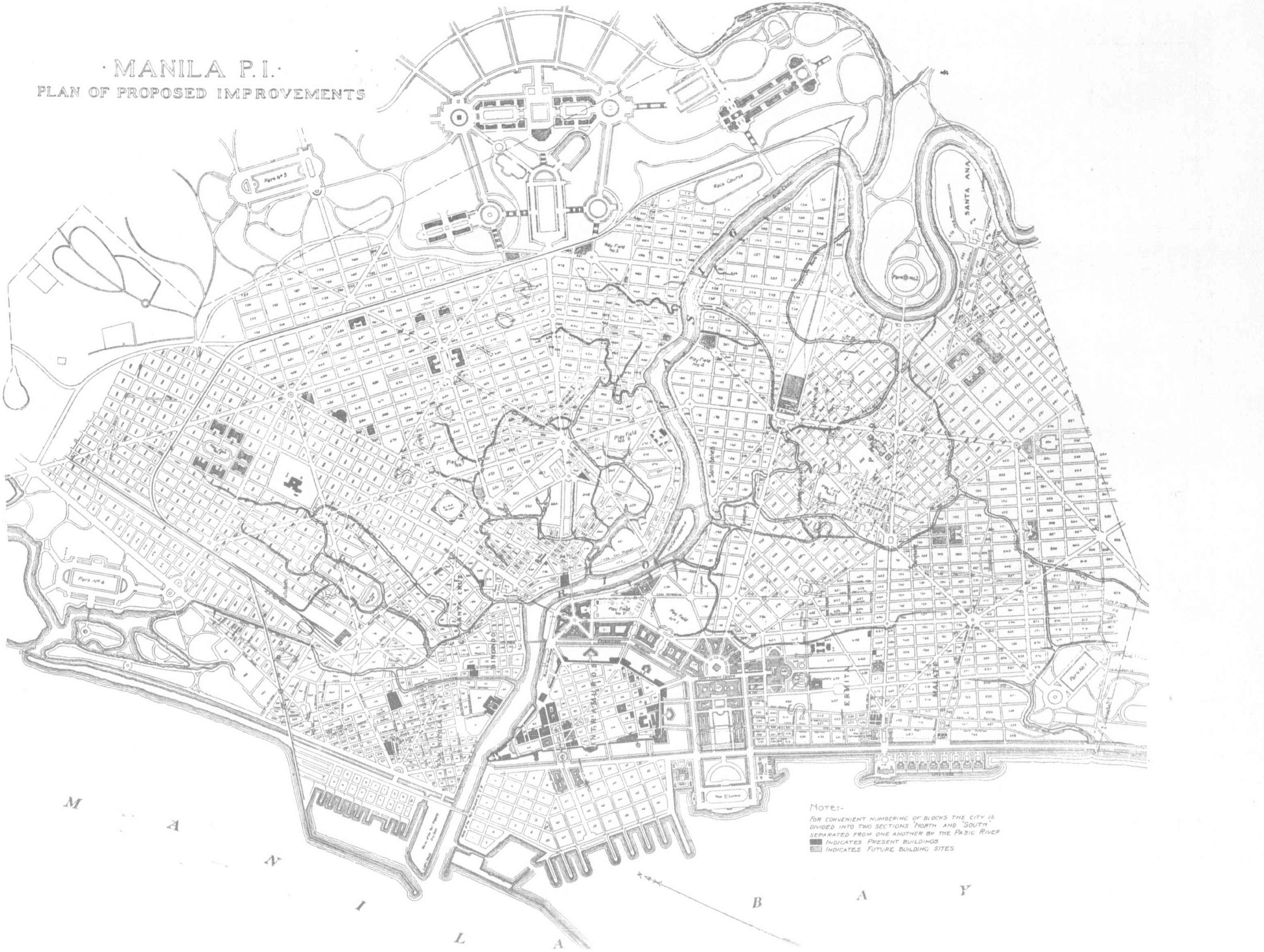
River drive.—The banks of the Pasig should have shaded drives beginning as close to town as possible and continuing up the river, the southbank drive going to Fort McKinley (this road is now open) and beyond this to the lake.

New Luneta.—The present Luneta, being covered by the Government group to be described later, is replaced by a new Luneta of the same size and shape and placed about 1,000′ further out in the bay on the new-made land. The objects of carrying the Luneta farther out are to restore its former commanding outlook, partially cut off by the new works of the port, and also to form a large pleasure park near the center of town and on the waterfront. This park, together with the Government Plaza east of it, forms a natural starting point for the bayfront boulevard and its extensions eastward and northward around the Walled City (Intramuros). The level of the new Luneta is slightly below that of the adjoining park, from the balustrades of which the spectator will have a view of the Luneta and a fine prospect over it towards the sea. The existing Luneta plays such an admirable part in the social life of Manila that its advantages should be preserved unchanged. To this end the new Luneta, like the present one, is left without planting of any sort on its westward side so as to give an unobstructed view of the sea. The other three sides are enclosed with a double row of trees in order partially to shut in the Luneta, to provide protection from the sun, and also in order to let the bay be seen from the park through a screen of foliage.

Parks and parkways.—The architects of all periods have recognized the fact that a building, however beautiful in itself, must fail of its highest effect unless provided with an appropriate setting, and in the study of these settings, parks and parking have always played an important part. The older cities of the world present numberless examples of the value of open spaces used to dignify important buildings, and in the arrangement of the proposed plan of Manila the most noteworthy examples have been frankly followed. Park spaces, small in extent, in the shape of plazas, circles, esplanades, park boulevards, have been laid out so that in any quarter of the city future buildings of importance may find already prepared for them a location susceptible of adequate treatment in its approaches and surroundings. The small square at one side of Calle Real, facing the present Manila (English) Club, is an example of what can be done to beautify a city by very modest means. Although it is both impossible and undesirable to fix at present the location of many future buildings, the adoption of a street system containing many definite sites especially adapted to organic grouping of buildings will encourage the location of future buildings at such spots; and this fact should induce the owners of real estate to lend their support to a plan in which generous use of parking will enhance the desirability of neighboring property.

If the use of the parks as an architectural accessory has long been common, it has remained for the modern city, with its immense and congested population, to show the necessity of them as breathing places for the people. These parks are oftenest of two types—playfields of moderate size in the heart of the city and large sylvan stretches located in the outskirts, where more ample areas permit the laying out of beautiful walks and drives in the middle of a romantic landscape.

Playfields.—Among the examples of the playground type are the 14 parks recently created by the South Park Board of Chicago. Averaging from four to 80 acres in area, these parks are destined to form veritable neighborhood


·MANILA P.I.·
PLAN OF PROPOSED IMPROVEMENTS
Park No 3
Race Course
Park No 2
SANTA ANA
Play Field No 5
Play Field No 4
Play Field No 6
Play Field No 3
Play Field No 1
Park No 4
Park No 1
SANTA CRUZ
ERMITA
MALATE
MANILA BAY
NOTE:-
FOR CONVENIENT NUMBERING OF BLOCKS THE CITY IS DIVIDED INTO TWO SECTIONS "NORTH" AND "SOUTH" SEPARATED FROM ONE ANOTHER BY THE PASIG RIVER
▨ INDICATES PRESENT BUILDINGS
▨ INDICATES FUTURE BUILDING SITES

club grounds for the use of the people. Each park povides facilities for the larger outdoor games, running track, separate outdoor gymnasia for men and women, large open-air swimming basins, swings, sand boxes, and wading pools for children. Each park has a club building, containing a large hall for public entertainments, in addition to reading rooms, indoor gymnasia, baths for men and women, and small swimming pools.

The value of these wholesome resorts in the center of a densely populated city can not be overestimated. Experience has shown that they almost entirely eliminate certain classes of crimes, and that their general effect is a marked improvement in the moral tone of the neighborhood. The new plan of Manila shows nine such parks, evenly distributed over the city. However wide the actual final location of certain of them may vary from the position shown on the plan, the principle of equal spacing over all city districts should be adhered to.

Informal parks.—Large parks, of which the location at a certain distance from the center of population does not interfere with their usefulness, will be chosen with especial regard to the landscape possibilities. Attractive stretches of water and ground of varying contours present the greatest resources. With regard to varying contours, the only spot where the uniform dead-level characteristic of Manila gives way to changes of elevation is northward of the city, from Santa Mesa toward the bay. On this higher ground at least one of the outer parks should be located (see park No. 3 on plan). With regard to parks determined by the use of water, three locations are suggested—one north of the city in the low ground about the Vitas Channel; another south of the city, where the Estero de San Antonio enters the bay, and a third east of the city, in the narrow bend of the Pasig, near Santa Ana. In the absence of contour maps and detailed information, however, regarding real estate conditions, no final design of parks could be attempted, and the parks sketched on the plan are intended merely as suggestions.

These parks are all made accessible from one another by parkway boulevards, so as to permit a continuous journey entirely around the city from park to park without losing at any point the refreshment of green foliage. Each park is furthermore made accessible from all city centers by boulevards as shown. To appreciate the value of these encircling parkways one has only to visit any French city of even moderate size. The exterior boulevard, wide and well-shaded, is seldom lacking. In crossing such a city one can often conveniently leave a narrow and ill-favored street and, without loss of time, enjoy a journey of some distance along a well-shaded parkway before again plunging into a less attractive quarter.

Fountains.—Whatever the value of parks and parking, their greatest charm and power of refreshment are only attainable in connection with flowing water. So clearly was the value of flowing water recognized in Rome that Emperor and Pope through the centuries have alike done their part in the creation of the fountains for which the city is so justly famous. Wherever one goes in Rome the gentle spray of water is ready to refresh the eye and the ear. Rome has seen many catastrophies, involving the destruction of public works, but the great gravity aqueducts still bring in their flowing water for the refreshment of the heat-ridden city. In Manila, it is hoped, in due time the same wide use of playing fountains will help mitigate the trying effects of a tropical climate.

STREET SYSTEMS.—The aim of the plan to realize ideal conditions in the unbuilt quarter of town must be seriously modified in the old built-up quarter, where the existing streets, bridges, and harborworks can not be ignored. In the proposed plan the general street arrangement is left substantially unchanged, and no demolition of buildings or changes in the direction of the streets are suggested, except such as seem imperatively called for to relieve present congestion and provide for the future needs of traffic. Should such changes appear excessive, two facts must always be borne in mind: First, that any plan worth the making is necessarily proportioned to future rather than present requirements; second, that the execution of a plan including laying down of street lines and preliminary purchase of available real estate must be begun early, even though left long incomplete, in order to avoid prohibitive future cost, due to rise in real estate values and the construction of costly improvements across the line of proposed streets. This immediate beginning is especially important at Manila, where the evils of congestion are even now manifest, where real estate values, though considerable, are only nominal compared with those of other cities, and where the existing buildings are for the most part cheap and poor in character. Every year's delay adds to the difficulty and cost of modifying the old street system; and if Manila is in future days to possess the qualities of beauty and convenience appropriate for the capital of a great nation, the present is the moment to take the initial steps, in order that time, with its inevitable changes, may aid the work rather than oppose it.

The first step consists in establishing the new street lines and purchasing such real estate as can be acquired without damage to property interests. It will probably be found that certain streets can be in this way entirely opened up at once. In certain other cases property interests would only allow the opening of a street in sections here and there. The completion of the work by removal of the remaining buildings can be left, as is done in Paris, for half a century, if necessary, until such time as public safety calls for their demolition, or until the owners on their own initiative decide to rebuild in accordance with the altered street lines. In this way a street once begun will tend to complete itself with increasing rapidity by the cooperation of the property owners themselves. A small present outlay will assure the ultimate completion of the improvement.

Old walls.—Certain of the old walls surrounding the Intramuros have been in existence since the end of the Sixteenth Century. Viewed as one of the few remaining examples of a mediæval fortified town, they possess singular historical and archæological interest, while their imposing appearance gives them great monumental value. The objections to their presence are based on alleged obstructions of traffic and ventilation. As obstacles to the free circulation of air, their moderate height compared with adjacent buildings seems to make them comparatively unobjectionable. With regard to their disadvantages as obstacles to traffic, their method of construction with massise corner bastions, making possible the piercing of an occasional gateway without destroying their effect, seems on this score also to leave them open to no serious objection. The new street openings should be cut through the massive projecting bastions at the angles of the Intramuros. These bastions being the nearest points to the Bagumbayan Drive, furnish the most available points for a roadway across the sunken lawns formed by filling the moats. Furthermore, an opening through these masses of masonry will be in a sense masked by the thickness of the walls, the entire opening not being visible to any spectator except one placed directly opposite the opening. Even wide openings at these points will still leave two masses so great as to constitute suitable flanking motives for a great gateway. Openings at other points than the corners will, on the contrary, cut through thin curtain walls, which are unsuited for adequate treatment as gateways except by the addition of a mass of architectural elements foreign to the simple and massive character of the walls themselves. The detached redoubts are left at the center of the sunken panels as isolated monuments. The old Camp Wallace bastion, which should be preserved for the sake of its historical interest, is supposed to be taken down and rebuilt between the old wall and the Malecón Drive at a point not far from the line of Calle Anda.

The moats.—The existing moat, necessarily stagnant, is open to such serious objections on both sanitary and æsthetic grounds that its elimination seems unavoidable. It should be filled up (this has been done since the rendition of this report) and the counterscarp which it incloses should be leveled off, so as to form sunken panels simply treated as a greensward without planting. This sunken garden will form useful playfields, and serve as a proper setting for the old walls, whose apparent height can be enhanced by establishing the level of the sunken lawn as far below the neighboring streets as proper drainage will allow. The tops of the walls, made accessible to pedestrians and planted with overhanging stone pines, after the matter of the beautiful inclosures of the Japanese castle in Tokyo, will become attractive lounging places, and seen from below across the stretches of open lawn will add a unique touch to the monumental aspect of the town.

Street system in the new quarter.—In the outer districts of the city, where no approved street system exists, and where no approved property stands in the way of a *de novo* arrangement, a street system is provided in accordance with the following principles:—

Avoidance of either north and south or east and west orientation of building sites.

Fan-shaped grouping of radiating streets.

Diagonal arteries, allowing direct communication from any city district to any other.

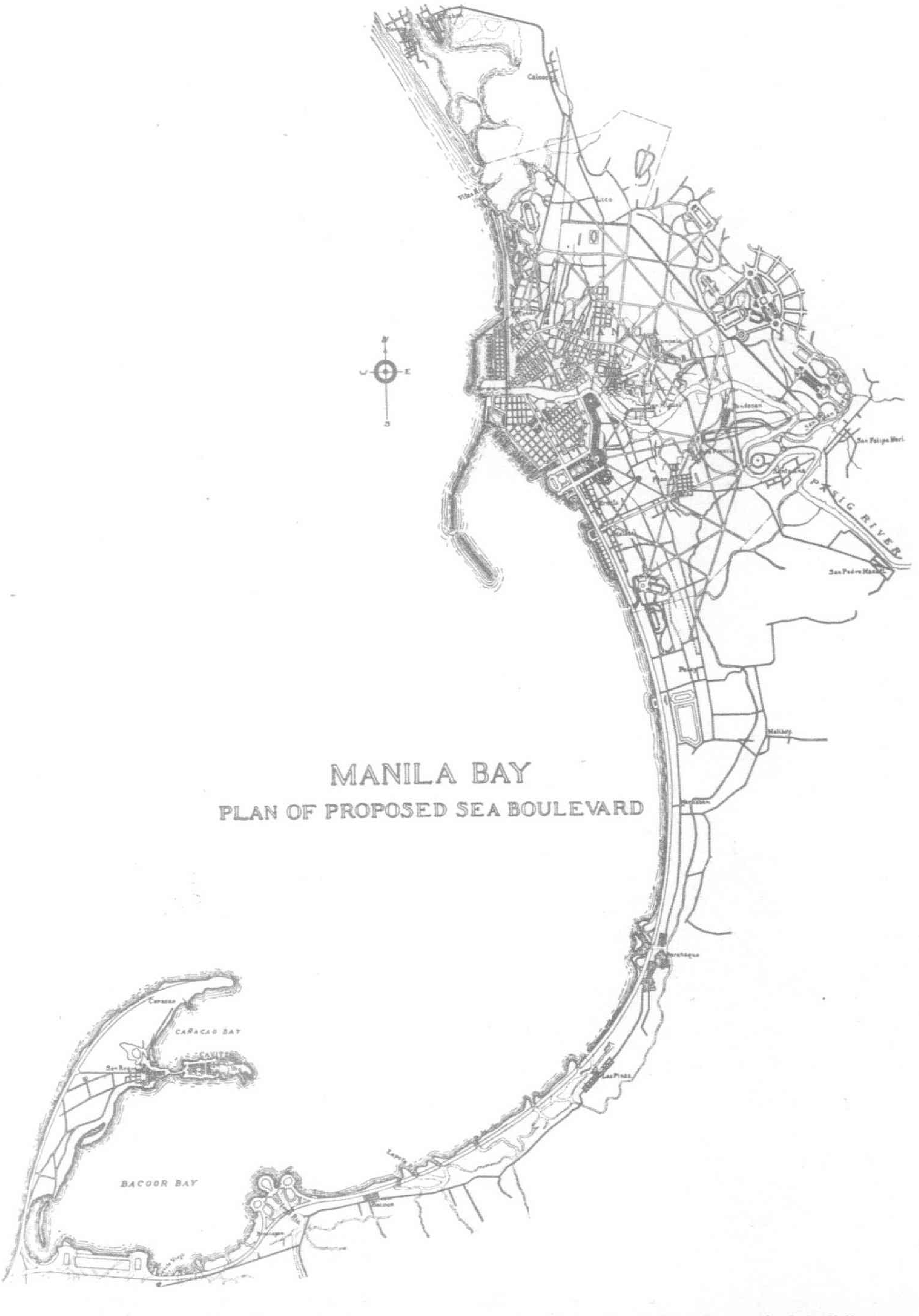
The avoiding of north and south or east and west orientation of streets allows each of the four sides of the house to have the advantage of direct sunlight at some time during the day, with consequent gain in ventilation and sanitation.

The radial street scheme divides the town into five sections, of which the center is constituted by the existing Intramuros and its adjacent territory. In each section the rectangular system prevails, one set of streets taking a direction toward the town center, the other set being at right angles to this direction, the general effect of the whole arrangement being a fan-shaped system radiating from the center and a tangential system skirting the inner city in a general circular direction. The reason of this arrangement is the fact that from any given point in the outer section of the city the volume of traffic toward the center will exceed the volume of traffic toward any other single point. Hence the advantage of a system which directs half the streets of a given quarter directly toward the busy center. The city most nearly suggesting this fan-shaped system is modern Athens.

The practical convenience of a rectangular street system for a small town needs no argument, but its extension over a large area means that a person desiring to cross town in a diagonal direction is subjected to a serious loss of time and waste of energy in *tacking* to the right and left to reach his destination. In a large city like Chicago this unnecessary waste of time means enormous annual money loss, and in case of fires may contribute to great disasters. Speaking generally, the planning of a town should be so carried out that a person may pass from any given point to any other point along a reasonably direct line. This has been accomplished in the proposed plan, somewhat as at Washington, D. C. —the best planned of all modern cities—by superposing a system of wide diagonal arteries on the rectangular system above described. These arteries, with the radial ones springing from the center, all of them being wider than the average street, permit parklike connections with space for trolley cars, reaching all important centers of the city.

Width of streets.—The avoidance of excessive cost of filling and the securing of protection from the sun call for streets as narrow as the needs of the traffic will allow. Such wider arteries as seem indispensable for each circulation should be well planted to provide ample shade, and in the wider avenues forming park connections the cost of filling can be reduced and the effect of the avenue enhanced by treating the center as a sunken lawn.

Summary; street system.—The aim of the proposed street system of Manila is, in brief, to leave the old city streets untouched except, for the creation of a few indispensable new arteries upon which work should be begun immediately. The old walls, left undisturbed except for street openings through the angle bastions, should have a setting formed by a sunken garden replacing the unsanitary moats.



MANILA BAY
PLAN OF PROPOSED SEA BOULEVARD

In the outer part of the town a rectangular street system insures sunlight on all sides of the houses, provides especially ample streets in the line of heaviest traffic toward the town center, and by means of radial and diagonal arteries makes every section of town readily accessible from every other.

In considering this street system, we should bear in mind that the presence of water very near the surface places almost prohibitive difficulties in the way of depressed or underground connections of any sort. So that, short of a recourse to expensive and objectionable track elevation, there is only one way to provide for ample traffic, *viz*, by sufficient street arteries. If any one fear that the plan as indicated goes beyond the probable needs of Manila, let him remember the foresight of Washington and L'Enfant, who planned a capital city of 800,000 souls for a country whose entire population was about 4,000,000.

LOCATION OF BUILDING SITES.—Among building groups the first in importance, the Government or national group, which would include capitol building and department buildings, is located on the present Camp Wallace and the adjacent land back of Calle Nozaleda. Grouping itself closely about the capitol building at the center, it forms a hollow square, opening out westward toward the sea. The gain in dignity by grouping these buildings in a single formal mass has dictated this arrangement, the beauty and convenience of which has been put to the test in notable examples from the days of Old Rome to the Louvre and Versailles of modern times. The entrance court on the town side is here referred to.

The eastern front of the Capitol group faces a semicircular plaza, from whose center radiates a street system communicating with all sections of the city—an arrangement entirely fitting for both practical and sentimental reasons; practical, because the center of governmental activity should be readily accessible from all sides; sentimental, because every section of the capital city should look with deference toward the symbol of the nation's power. The plaza allows space at its center for a national monument of compact plan and simple silhouette.

Hall of Justice.—The court-house or Hall of Justice is given a separate location south of the main group and heading the vista down the avenue which passes the east front of the Capitol. The practice, too common in the United States, of grouping Courthouse and Postoffice in one building, while convenient and economical from the point of view of Federal administration, is in other respects unfitting. The Postoffice is a business machine affecting public interests. Its character, consonant with its practical necessities, is commercial. The Hall of Justice, on the contrary, far from being solely a business machine, represents sentimentally and practically the highest function of civilized society. Upon the authority of law depend the lives and property of all citizens, and the buildings which constitute the visible expression of law, its symbol of dignity and power, should be given the utmost beauty in their location, arrangement, architectural treatment, and approaches. A Hall of Justice should be treated as a thing apart, a thing majestic, venerable, and sacred. It should above all be free from the clatter of commerce, and in its architectural expression should speak the greatness of its function. The moral effect of such a Hall of Justice, magnificent in outward form and aspect, compelling an attitude of respect, if not inspiring a feeling of awe, would be cheaply secured at large sacrifices of space and money.

Library, museum, exposition buildings.—Stretching from the Government group northward along Malecón Drive toward the Bridge of Spain are spaces for a number of semipublic buildings, such as libraries, museums, and permanent exposition building. The termination of this group forms a central circle, from which radiates the three most used bridges over the Pasig. The lines of Malecón Drive have been changed in order to reduce the street scheme to an orderly arrangement running parallel with the old walls and with them forming a consistent architectural composition. The Malecón Drive has also been widened to 250', so as to form the continuation of the ocean boulevard.

It is fortunate that the existing buildings in this quarter, municipal building, barracks, First Reserve Hospital, and others, are so located and of such a character as to afford no serious obstacle to carrying out the improvement The value of the athletic fields near the town center is recognized by placing back of the libraries and museums two fields to replace the existing Camp Wallace playground.

Postoffice.—The Postoffice, requiring frontage on the river for easy water transportation of mails, is located south of its present temporary site. If possible, the river bank should be left unobstructed here as elsewhere, and water approach provided by means of slips. This central location with converging avenues will make the building readily accessible from all sides.

Railway station.—One of the arteries radiating from the Government center leads directly to the proposed passenger railway station, centrally located, with reference to Greater Manila, between Paco and Pandacan. This station, which is one of the two vestibules of the city—the port being the other—thus stands in reciprocal relation to the administrative and governmental center. The station is furthermore connected by its own system of radiating arteries with all quarters of the city. This location was determined by the double advantage of being near the heart of Greater Manila and of occupying a bend in the Pasig River such that the necessarily extensive development of the terminal property (for car storage, roundhouses, coalyards, cleaning yards, etc.) could take place with less cutting of traffic than at any other location, the river at this point furnishing a natural barrier that in any case would be crossed by infrequent bridges.

Railway approaches.—The railroad approach to the passenger station is over a bridge south of Santa Mesa Heights. The future southern lines will enter the station over this bridge, after previously crossing a second bridge from the south side of the Pasig. This does not necessarily involve trouble for the southern lines, since the northern lines will in any event need a bridge connection with the southern lines outside of the city limits, the Manila & Dagupan Railway having in fact already secured a right of way for such connection. On the other hand, to bring the southern lines to the station by a lateral approach inside city limits, and without crossing the Pasig, will interpose a serious barrier to the growth of Manila southward and eastward. The avoidance of such an obstacle should not in any event be prevented by the cost of a railway bridge. And an additional bridge is not a serious hindrance to navigation in a city where many bridges are inevitable.

The existing railway line to Antipolo puts between Manila and its valuable high ground near Santa Mesa a barrier that should, if possible, be minimized at some future time by converting the line to a suburban electric road and by securing a railroad outlet farther from the town center.

Municipal group.—The Municipal group, more important than any other except the Government group and the Hall of Justice, is supposed to include the Ayuntamiento and to be grouped around Plaza McKinley. The plaza might be enlarged by adding the block upon which the unfinished Spanish building stands. The plaza thus opened out to the Malecón Drive connects with a second plaza on the new-made ground, facing the proposed Customhouse, Board of Trade, Commercial Museum, and other semipublic buildings, and forming an impressive composition. The Customhouse so located would be in convenient relation to the port and the city. The axis of the Municipal group continues clear to the waterfront, where a special pier with enlarged approaches and suitable accessories will lend itself to treatment in accord with this function as the principal water gate of Manila. The water gate, like the railway plaza, needs ample space for handling crowds of spectators and massing troops in connection with such public ceremonial as take place from time to time at the entrance of a great capital.

Official residences.—In the belief that the bay front, with its boulevards and parks, is the natural theater of the social life of Manila, the residence of the Governor-General is located in the bay outside of the boulevard on the new-made land facing an esplanade cut through the existing Malate military reservation. Fronting the residence of the Governor-General and facing one another on opposite sides of this esplanade are the houses of the Major-General commanding the Division of the Philippines and the Vice-Admiral of the station. From this esplanade, the center of official life, radiating arteries reach out to all sections of the city.

Social clubs.—Stretching south from the Governor-General's residence, also on new-made land, extend a series of city clubs, whose character as semipublic institutions justifies giving up to them a portion of the waterfront. Each club will have ample grounds for gardens and outdoor games, as well as a broad terrace on the seaward side with suitable planting for protection from the sun's glare and the typhoon. It is believed that the close grouping of these clubs, as in London, will enhance their value to the whole community. The concentration of social activities through the related grouping of official residences, hotels, and clubs in parkway boulevards and gardens along the waterfront will, it is believed, make possible an attractive social life that will bring many influential people to Manila and count for much in the prosperity of the islands. The delightfulness of a city is an element of first importance to its prosperity, for those who make fortunes will stay and others come if the attractions are strong enough, and the money thus kept at home added to that freely spent by visitors will be enough to insure continuous good times. The aim should be to make Manila, really, *The Pearl of the Orient.* Along the shore, beyond the city limits to the south, is shown a suitable location for a country club, the main club buildings being located inside the ocean boulevard, but with space reserved for certain buildings on new-made land between the boulevard and the sea.

New Hotel.—To the north of the Luneta park is a space approximately 500×600′ reserved for a hotel whose size, surroundings, and appointments are intended to deliver Manila once for all from the standing reproach of inhospitality toward a traveler. A hotel on a sufficient scale in this location could be made renowned the world over and constitute in itself alone an attraction strong enough to draw to Manila every traveler in the Orient. With three sides fronting on parks and boulevards, and the fourth side fronting the sea, the hotel site offers every possibility for a world-famous resort.

Casino, public baths, boat clubs.—Opposite the hotel site and south of the park provision has been made, on a space 300×600′, for small boat clubs, a casino, and public baths. The suitability of this point for bathing facilities will depend on the formation of a beach by silting of the sand against the new retaining wall.

School center.—A group of schools forming perhaps a university, would be well placed on Santa Mesa Heights, having the advantages of proper detachment from the city, good air, high ground, and available water for aquatic sports.

Charitable institutions.—The high ground north and east of the city is also well adapted for parks as well as hospitals, sanatoria, asylums, and other semipublic institutions demanding a quiet location conveniently accessible from the city. While no such groups can be designed at present, the plan shows the kind of arrangement that could be used to advantage on this exceptionally favorable ground, and provides for an improvement that will be inevitable in the course of time.

DEVELOPMENT OF WATER TRANSPORTATION.—The new port work with its necessary railroad facilities, demands a railroad approach from either the south or the north side of the river. The railroad already exists on the north side and its continuation to reach the new-made land can be accomplished by bridging the Pasig near its mouth. On the other hand, a railway approaching the harbor from the south side of the town would cut through the city in such a way as to destroy real-estate values and also be a constant source of danger unless the tracks were elevated. But the expense of track elevation is clearly prohibitive for a long time to come. The lesser evil is, therefore, a railway drawbridge over the Pasig. Such a bridge across the mouth of a stream running at certain times at 10 knots an hour constitutes, in the opinion of experts, a serious hindrance to navigation, and will materially reduce the value of the river frontage above the drawbridge. This frontage, limited by the Bridge of Spain, is already unequal to the existing demands, and will call for extension in the near future.

The additional wharfage, if found in the new port, would be far from the present business district in San Nicolás and Binondo, so that unless business should consent to move south of the river, an additional harbor north of the river seems inevitable. Such a harbor entered from the present 18′ channel, is shown on the plans in close relationship with the business and railway freight district. This harbor of moderate depth for coastwise steamers lends itself to indefinite extension northward at comparatively small expense, the area of valuable reclaimed land being considerable in proportion to the cost of retaining walls built in shallow water. There is little doubt that private corporations, in the absence of Government initiative, would be glad to undertake such improvements in exchange for privileges in connection with the new-made land.

Esteros.—The narrow canals or *esteros* ramifying throughout Manila, with their almost stagnant water and their unsanitary mud banks, would appear at first sight to be undesirable adjuncts of the city. Yet for tansportation purposes they are of the utmost value, and in spite of the serious problems involved in properly widening, bridging, and maintaining them they should be preserved. In the coast cities of the Orient *esteros* are numerous, and it is a long-fixed habit of the people to transport goods upon them, their availability for the poorest boatman making them peculiarly valuable. To develop the full usefulness of the system, certain of the *esteros* should be filled up and the others widened and dredged to a practical depth; all of them should be provided with masonry banks. So treated they will offer an economical and unobjectionable means of freight handling that will greatly contribute to the prosperity of the city.

A complete development of the *estero* system would comport an *estero* connection, as suggested by Major James F. Case, between the Pasig River and the Vitas Channel, while an amplification of the *estero* system connected with the Pasig River near Santa Ana, and opening into the bay through the San Antonio *estero*, might serve by its independent channels materially to diminish the danger of overflow of the Pasig.

The *estero*, it should be remembered, is not only an economical vehicle for the transaction of public business; it can become, as in Venice, an element of beauty. Both beauty and convenience dictate a very liberal policy toward the development of these valuable waterways.

River banks.—In addition to creating on the river banks a continuous shaded drive in the outer districts, every effort should be made to establish an open quay along both river banks in the business parts of the town in order that river steamers may make the frequent landings demanded by the public service. Large manufacturing houses can serve their own interests without inconvenience to the public by building river slips or branches of the *estero* system on their own ground, as suggested for the proposed new postoffice The river banks should be everywhere available for the use of the public.

SUMMER RESORTS.—The climate of Manila seems to call for the establishment of accessible summer resorts on high ground, and however useful Baguio may be as a health resort, no town a hundred miles or more from Manila can entirely take the place of comfortable resorts within easier reach of the capital. The low hills near Manila on the east, the higher mountains of Mariveles across the bay, the hill country surrounding Laguna de Bay, all offer possible locations for summer resorts within easy range of the city and furnishing change of air for the families of government employees without the drawback of family separation and great cost of transportation.

FUTURE BUILDING METHODS.—The first consideration in determining architectural style is the question of adaptability to local conditions. In any given locality the things already existing as a result of long experience are likely to prove the best. In Manila this general rule seems to apply with especial force.

Overhanging second stories.—The wooden houses with overhanging second stories and continuous window screens are convenient, practical, and artistically admirable. Owing to the difficulty of locating telegraph and telephone poles in the narrow streets bordered by houses with overhanging second stories, the municipal board of Manila has recently adopted the policy of prohibiting the further construction of projecting second stories in narrow streets. In view of the pleasing effect and adaptability to the climate of this characteristic style of construction, its suppression is regrettable. Some other method of supporting electric wires—perhaps from the housetops—might be devised in order that a desirable method of building may not be discontinued.

Tile roofs.—The beautiful roofs of Spanish tile are also rapidly losing ground before the invasion of galvanized iron. While the cheapness of the iron roof recommends its use for temporary service, there is no doubt that for permanent buildings the long-lived Spanish tile will prove more economical. And an examination of some of the very old tile roofs of Manila leads to the conviction that the alleged dangers of tile roofing, in an earthquake country, have been greatly exaggerated. In the matter of tile roofing, as in other building matters, the Spanish traditions are deserving of acceptance

Masonry construction.—In a tropical climate costly structures put up with granite, marble, or other building stones, in the manner of public buildings in Europe and America, would be out of place. Flat walls, simply built of concrete (with steel reenforcing rods to resist earthquakes), and depending for their effect upon beautiful proportions rather than upon costly materials, are from all points of view most desirable for Manila. The old Spanish buildings with their relatively small openings, their wide-arched arcades, and large wall spaces of flat whitewash, possess endless charm, and as types of good architecture for tropical service, could hardly be improved upon. To mention a few examples in Manila: The Ayuntamiento, the Intendencia, the Cathedral, the tower of Santa Cruz, the circular cemetery on calle Nozaleda, and the inner court of the present constabulary barracks at Parañaque are especially noteworthy.

CONCLUSION.—The above description of the existing conditions with suggestions as to their most obvious possibilities, shows that improvements of great scope are attainable in Manila by reasonable means. On the point of rapid growth, yet still small in area, possessing the bay of Naples, the winding river of Paris, and the canals of Venice, Manila has before it an opportunity unique in history of modern times, the opportunity to create a unified city equal to the greatest of the Western world, with unparalleled and priceless addition of a tropical setting.

In keeping pace with the national development and in working persistently and consciously toward an organic plan in which the visible orderly grouping of its parts one to another will secure their mutual support and enchantment, Manila may rightly hope to become the adequate expression of the destiny of the Filipino people as well as an enduring witness to the efficient services of America in the Philippine Islands.

HONGKONG AND WHAMPOA DOCK COMPANY, LTD.

The ordinary yearly meeting of shareholders in the Hongkong and Whampoa Dock Company, Ltd., was held in the offices of the company, Queen's Buildings, Hongkong, recently, and the report of the directors and the statement of accounts to December 31st, 1906, were received. There were present Sir Paul Chater (chairman), the Hon. Mr. W. J. Gresson, Messrs. E. Goetz, A. Haupt, G. H. Medhurst, N. A. Siebs, S. Silverstone, J. S. Van Buren, D. W. Craddock, and H. P. White (directors); W. Wilson (acting chief manager), T. I. Rose (secretary); R. J. Audap, J. P. Braga, G. de Champeaux, Chau Siu Ki, Choa Leep Chee, Capt. W. E. Clarke, Messrs. Albert Denison, F. E. Ellis, E. Georg, Ho Fook, W. C. Jack, E. J. May, S. H. Michael, S. J. Michael, E. J. Moses, W. Parlane, Thomas Skinner, H. Percy Smith, W. H. Wickham, and A. G. Wood.

Chairman's Address.—The chairman's address was as follows:—"The report and statement of accounts having been in your hands for some days, I will, with your permission, take them as read. The net profits for the half year ending December 31st, 1906, amount to $369,596.36 as compared with $403,256.44 for the first six months of the year, and $171,649.83 for the corresponding period of 1905. To this sum must be added the sum of $392,087.38, the balance brought forward from last account, and after deducting directors' and auditors' fees we have available for appropriation the sum of $750,933.74, which sum your directors propose, subject to your approval, to deal with as follows:—To pay a dividend for the half-year of 12 per cent or $6 per share absorbing $300,000, to place $50,000 to the credit of a special account to be called 'No. 1 Dock Extension Account,' and to carry forward the balance $400,933.74 to a new account. Appropriations which will, your directors trust, meet the wishes of the shareholders. While in view of the disastrous typhoons which occurred in September last, and the vast amount of the work for the company resulting therefrom, it may at first sight appear that our earnings for the past six months are somewhat less than might have reasonably been expected, it must be borne in mind that the whole of this work has not yet been completed and consequently the period now under review does not reap the full benefit thereof, several large repairing jobs remain yet to be done and the profits arising therefrom will come into the accounts for the current six months, and while on this subject it may be interesting to you to learn to what extent we ourselves suffered by these same typhoons. I am pleased to state that the amount of damage done to your property was comparatively slight, approximating in all only some $53,800. Two of our launches were submerged; they have since been raised and fully repaired at a cost of $9200 which sum has been passed to the debit of marine insurance ℀. The caissons, sea-walls, wharves, buildings, etc., at our three establishments sustained damage to the extent of about $44,600, of which $27,132 has already been paid for repairs executed and passed to the debit of working ℀., leaving $17,-[illegible] to be expended during the current six months; taking into consideration the tremendous havoc wrought by the blow of September 18th, throughout the colony, but more particularly on the Kowloon side, I think it is a matter for congratulation that we escaped without sustaining far heavier damage. The tonnage of British and foreign men-of-war docked during the past six months shows a decrease of 73,500 tons, a falling off largely attributable to the arrival in the Philippines of the floating dock, not a single American vessel having come to us for docking since then. On the other hand, the tonnage of merchant vessels shows an increase over the previous six months of some 10,098 tons, the tonnage docked since 1st July being for this class of vessel 466,369 tons. While we have not been engaged in the construction of any large vessels lately a glance at our report will show that we have not been idle in the building yard, quite a number of small craft having been turned out and others are now nearing completion; this work together with the repairs to the numerous vessels damaged in September last has kept us fully employed for months past. Towage and dredger ℀s.—You will be pleased to see once more on the right side of the accounts. The value of 'materials on hand' is about the same as in the last account, while work in progress shows an increase of about $82,000. The purchase of the land at Kowloon referred to at our private meeting in August last is completed, and we have now under consideration tenders for the work of removing the hill and lengthening the No. 1 Dock. We propose carrying on this work with our own staff, and, as I have already mentioned, recommend passing the first sum of $50,000 to an account specially to defray the cost of this undertaking and we hope to be able to carry it through without making any call upon shareholders for increased capital. Before moving the adoption of the report and accounts I shall be pleased to answer to the best of my ability any question you may wish to ask."

Mr. Wood's Remarks—Mr. A. G.Wood, in seconding, said—"I have much pleasure in seconding this resolution, which must, I think, be considered satisfactory. It is also satisfactory to learn that we suffered comparatively so little loss from last September's typhoon, while there is still an amount of work in hand arising from that calamity. I am sure that our shareholders have heard with pleasure what you have told us about the dock extension now being taken in hand. Many may perhaps agree with me in regretting that we are at the commencement of the work instead of at its completion; we would have then been in so much better a position to meet the increased competition we have to expect. I understand that Sir Paul Chater is vacating the chair which he has occupied for four years. So I ask you to join me in thanking him for the valuable services, he, with the assistance of his colleagues, has rendered to the company, and in hoping that his successor's labours in the chair will continue to promote its success. I do not know that I can suggest a more efficient spur than by pointing to the fact that at this time last year our shares were quoted at $163 and now they are at $140. I have much pleasure in seconding the motion.

The report and accounts were adopted unanimously.

Mr. Georg moved that the appointment of the Hon. Mr. W. J. Gresson and Mr. D. W. Craddock to the directorate be confirmed.

Mr. A Denison seconded and the motion was carried.

Captain Clarke moved the re-election of Mr. N. A. Siebs and the Hon. Mr. W. J. Gresson.

Mr. Jack seconded and the motion was adopted.

Mr. Parlane moved the re-appointment of Messrs. H. U. Jeffries and H. Percy Smith as auditors.

Mr. Ho Fook seconded and the motion was adopted.

The Chairman—Dividend warrants will be ready to-morrow. Thank you for your presencee.

The meeting then ended.

OIL FIELDS OF SAGHALIEN

There is no doubt in the minds of Oriental experts that Saghalien will, in the near future, take an important place in the production of coal and oil for the markets of the Far East. As most of the mineral bearing regions fall to the lot of Russia in the delimitation of the island almost completed by the international commissioners, Japan loses a source of enormous wealth, the anticipation of which doubtless had much to do with her almost universal dissatisfaction over the terms of peace. The coal deposits of Japan itself are of vast extent, but the quality of all so far produced is not that of a first-class fuel; and the oil-fields of the country, though being fast pushed to the limit of development, are yet unable to supply the home demand, and the deficiency has hitherto been met by importation from the Baku fields, and those of the United States.

The Saghalien coal beds were opened as far back as 1858, but as the work has been carried on by means of convict labour, the least productive of all industrial activities, the development has been extremely sluggish and generally unsatisfactory. An incompetent and irresponsible administration has naturally resulted in a ruthless waste of time and product. Some of the big seams set on fire by rebel convicts thirty years ago, are still smouldering. Most of the hard-labour convicts are not properly under the control of their masters, and many of those toiling in the mines by day, spend their nights plundering the neighbourhood, and are able to "make it all right" with their guards in the morning.

The most important coal-producing districts are along the west coast of the island the chief centres of operation are at Due and Vladimirsk. Seams of the mineral have also been seen exposed along the banks of the river Tim.. Most of the Saghalien deposits are near the surface, and the coal is mined with but little difficulty. The convicts simply approach the coal on the level and tunnel into it, and thus they go on until, finding themselves inconveniently situated, they abandon the spot but half exploited, and turn to a more tempting place. Today the Vladimirsk region looks like a vast rabbit warren. Yet the output equals about two-and a half million tons annually.

All the coal so far found in Saghalien has proved to be of a most excellent lignite quality, on the whole far superior to Japanese coal and commanding a much higher price. The convicts are supposed to have 10 per cent. of the value of the output divided among them as wages, and the coal sells at from -Y-5 to -Y-6 a ton on board.

Facilities for transportation and lading, however, are of the most primitive and inadequate kind, entailing great uncertainty in the fulfilment of contracts, and seriously diminishing their number. The greatest difficulty is in the absence of any safe anchorage for ships, made doubly dangerous by the extreme fickleness of the weather. If a high wind should arise, as it frequently does, all loading operations have to be suspended, and the vessel must put to sea or be driven upon the rocky coast.

Happily a scheme is now on foot, and doubtless will be carried into effect, for the building of a mole from Jonquiere Head to the *Three Brothers* rocks, which will afford a much needed shelter for shipping. Also, a railway is being laid from the mines to Alexandrovsk, the chief town and port of the north, and when these improvements are completed, the process of lading will be more simple, regular, and dependable, and the coal can be delivered at a more reasonable rate.

The present method of coaling a ship presents a scene more absurdly slow and antiquated than can be seen anywhere else in the world. Twenty-five convicts have been known to take a whole day to put on board as many tons. Another ship could get but 2,000 tons into her bunkers in three weeks. Such conditions as these have so far kept Saghalien as a competitor out of the coal markets of the Orient; but the material is there, and no more than brains and capital are required to make the island one of the most profitable and satisfactory of coal-producing lands.

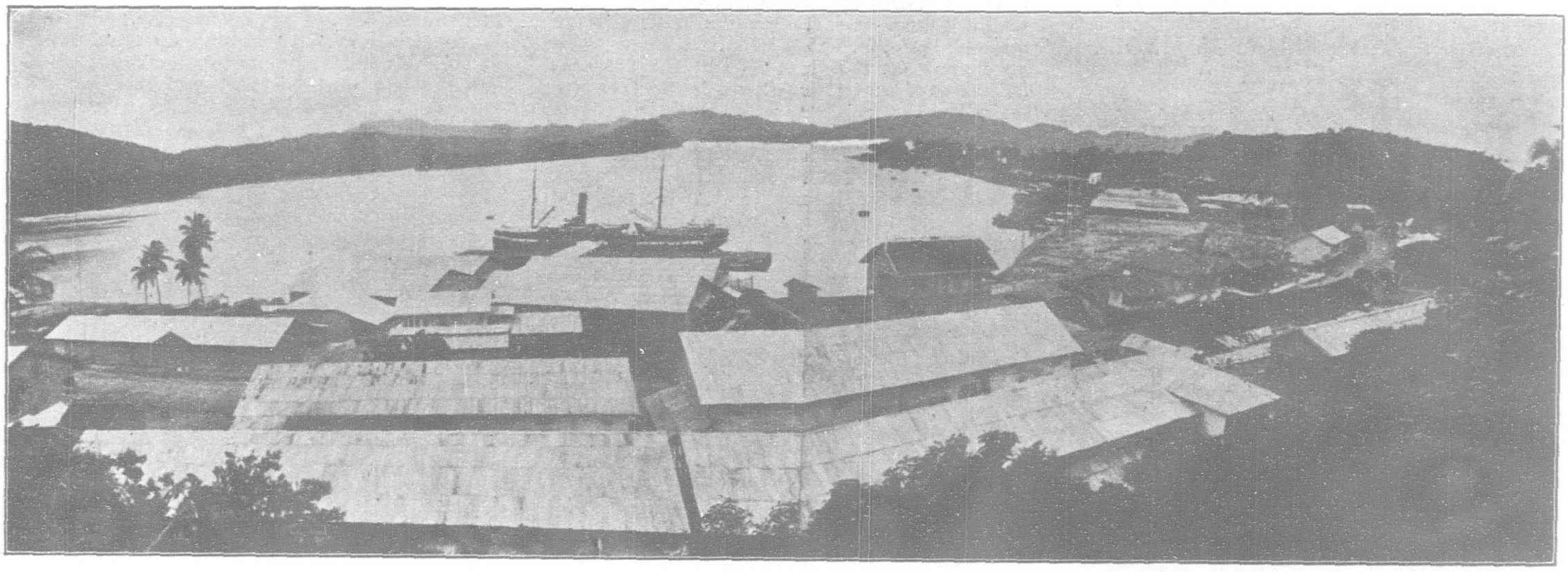
The oil-fields of Saghalien are believed to

(Continued on page 329.)

Coal Industry of the Sabang Bay Harbor and Coal Company, Island of Pulo Weh

In view of the interest which has of late been manifested by steamship owners in the growing port of Sabang Bay, North Sumatra, some reliable data, both historical and commercial, with regard to this harbor, the trade expansion of which can best be described as phenomenal, will no doubt be of value.

Up to about 1893, Sabang Bay, and indeed the Island of Pulo Weh, in which the harbor is situated, was inhabited by only a small number of natives. In this year the advantages of Sabang as a base for the numerous Dutch gunboats, etc., then occupied in subduing the Achinese, became recognized, and with this in view a workshop fitted for ordinary repairs to steamers was erected, and a Government floating dock with a lifting capacity of 3,000 tons was installed, and is in use at the present time. It is only, however, within the last five or six years that the remarkable situation of Sabang as a port of trans-shipment for the rapidly-growing trade of the northern part of Sumatra, and as a coaling port for steamers proceeding through the Straits of Malacca, has been fully appreciated.



GENERAL VIEW OF THE PORT OF SABANG, UNDER CONTROL OF THE SABANG BAY HARBOR AND COAL COMPANY

UNDER PRIVATE CONTROL.—From the inception of its commerce, the Port of Sabang has been under the control of a private concern. The Sabang Bay Harbor and Coal Company, which, under the immediate auspices of the Netherlands Trading Society, has shown commendable energy in pushing the fortunes of its undertaking. When it is said that this private company has had to build the entire stretch of magnificent wharves which now line a large part of the bay, from its own funds without Government subsidy, it will be seen that those most intimately interested have been possessed of ample faith in the future of their venture.

As a coaling port, the geographical position of Sabang could not be more advantageous. Lying exactly in the track of all vessels proceeding to or returning from the Far East, either *via* the Suez Canal, or the Cape of Good Hope, it represents almost precisely the halfway station between Port Said (or Durban) and the coal ports of Japan, and during the southwest monsoon a further advantage accrues to Sabang, since steamers bunkering there can take the southern route across the Indian Ocean, thus avoiding the full strength of the monsoon. That these advantages are appreciated the growth in the coal trade of Sabang, which in 1902 only amounted to 23,000 tons, advancing in 1905 to nearly 100,000 tons and in 1906 to more than 120,000 tons, is confirmed in no uncertain manner.

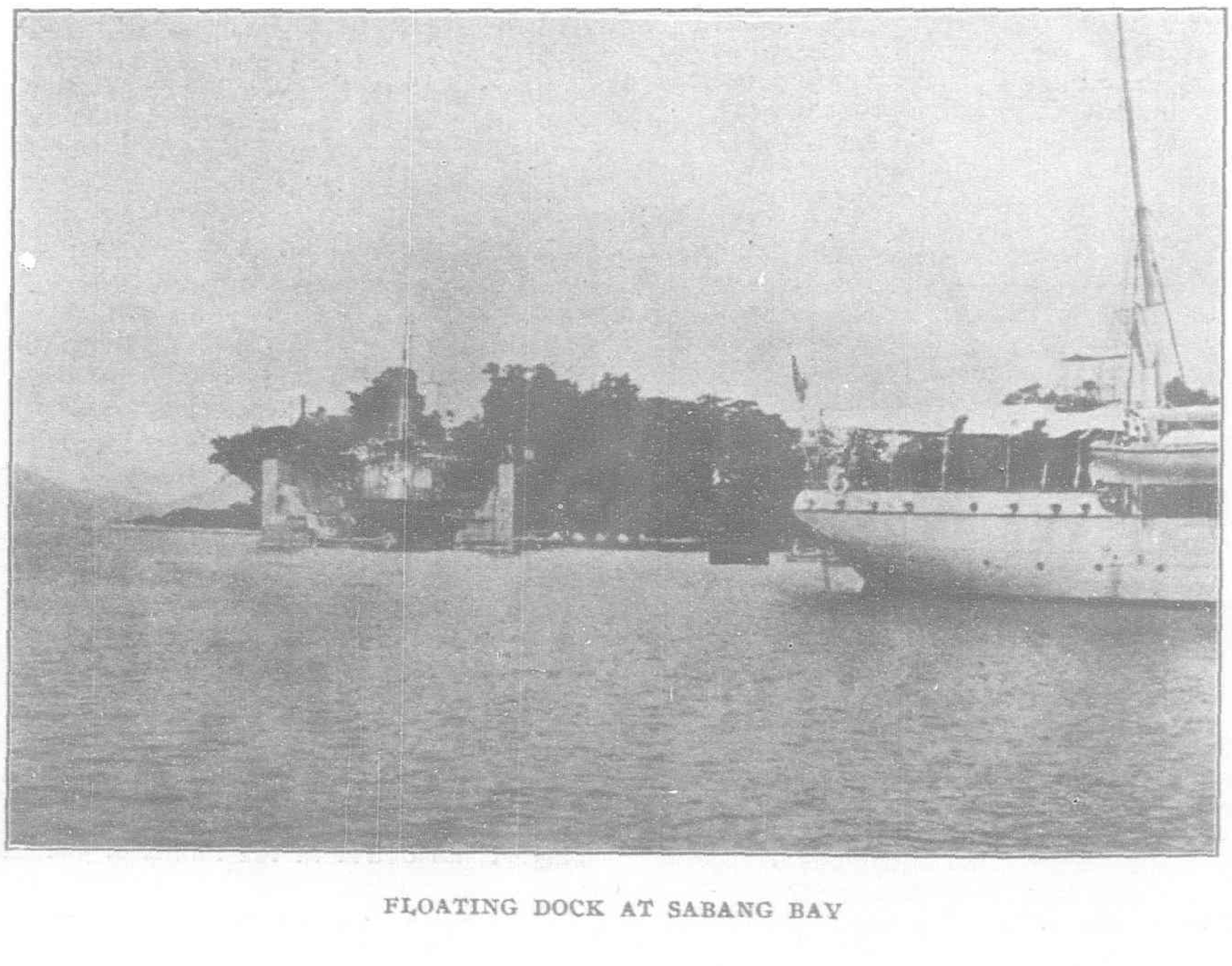
COAL SUPPLY AND COST.—In addition to the advantageous geographical position of Sabang, it must also be recognized that these results are the consequence also of the rapid despatch and the moderate price at which coal can be sold there. These advantages are obtained from the extensive use of labor-saving apparatus, the company having installed a plant consisting of four electric transporters, each weighing 120 tons. These transporters run on rails all along the numerous coalsheds, which are now 24 in number, and when discharging a cargo, iron buckets containing 25 hundredweight of coal are filled in the holds of the colliers, thence lifted and carried by travellers above the sheds from which points they are lowered through hatches and automatically capsized upon touching the coal heap. In this manner any rough handling of the coal is effectively obviated.

In the reverse operation of bunkering, buckets are also used wherever possible, but owing to the construction of steamers it frequently happens that part, at any rate, of the coal must be placed on board with baskets. In such cases the baskets are filled in the sheds and carried on board by the travellers where they are deposited in the most suitable spot for the completion of the operation by the force of coolies employed by the company.

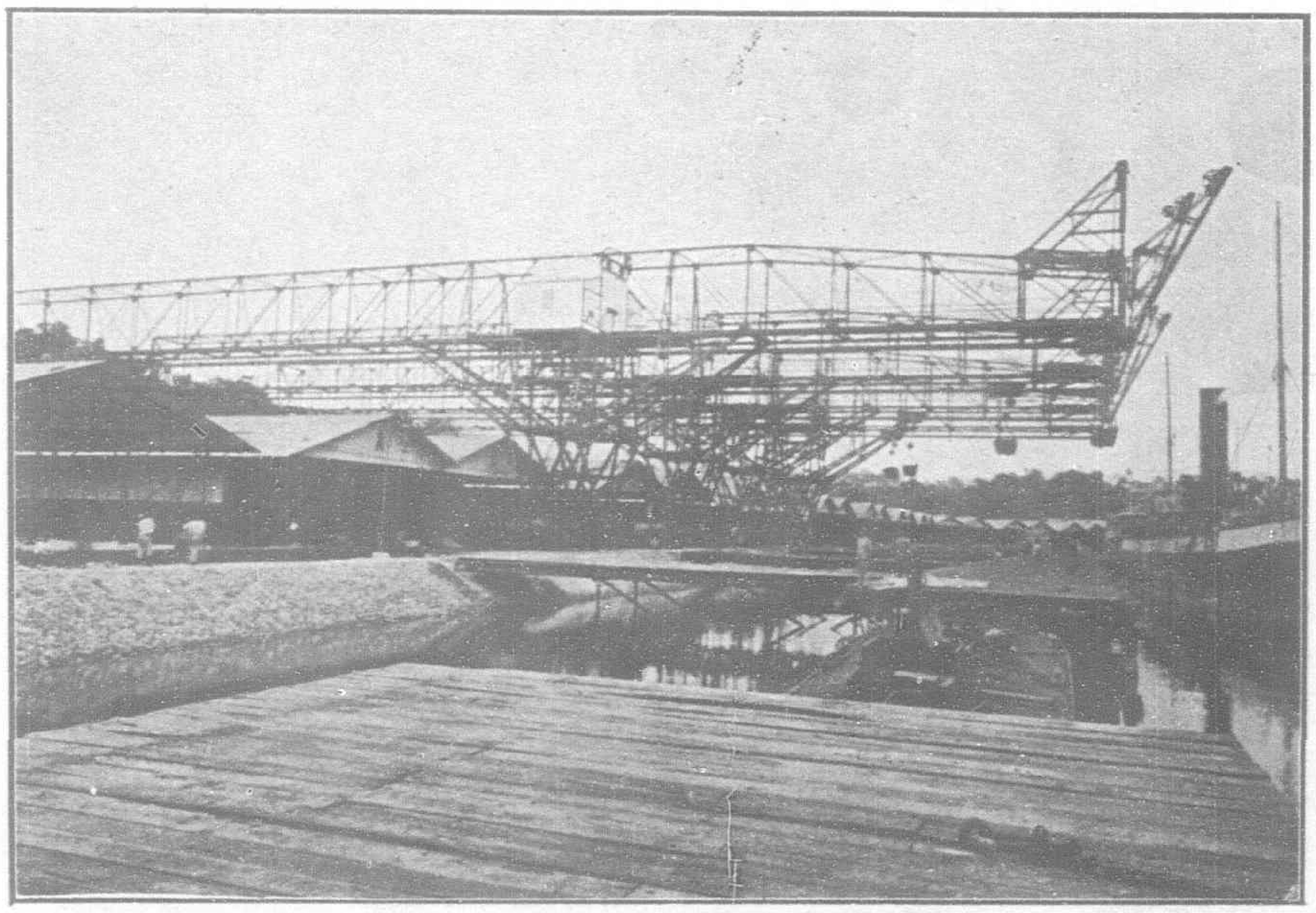
These transports have now been in use for more than two years, during which time they have worked to the satisfaction of the company, and also to the satisfaction of the steamship owners using the port, who have benefited by the quick despatch obtained. The company is to be congratulated upon its enterprise and forethought in installing machinery, which, although involving a large expenditure of money, is undoubtedly doing its part in advancing the general interests of the port. Another reason for the popularity of Sabang as a coaling station is that the company has from the first made no charge for harbor dues, pilotage, etc., on steamers calling for bunkers, all such charges being invariably included in the prices quoted for coal. This absence of charges involves also a complete absence of many of the formalities and petty delays so irksome to captains and owners.

The descriptions of coal principally supplied at Sabang are Bengal and Sumatra (Ombilin), in addition to which, however, stocks are also kept of the best Cardiff and Japanese production.

GENERAL COMMERCE.—From the standpoint of general commerce, Sabang may claim to be rapidly becoming the principal trans-shipment port for the exports and imports of the northern part of Sumatra, the trade of which is expanding by leaps and bounds. To provide for this trade, the Sabang company has established godowns for the storage of merchandise, covering an area of 45,000 square feet. The imports consist chiefly of European goods discharged from the mail steamers of the Netherland Steamship Company, which are trans-shipped on board the local steamers of the Royal Dutch Packet Company, which, together with some Chinese-owned coasters under the British flag,



FLOATING DOCK AT SABANG BAY



BUNKERING PLANT AT SABANG BAY

also afford regular communication with Penang and Singapore.

Since the middle of last year the two Dutch mail lines, the Netherland and Rotterdamsche Lloyd, have started a regular joint service of cargo boats, running between Java and Calcutta, and calling at Sabang and Rangoon. The Asiatic Steamship Company, which already supplied a regular service between Java and British India, thereupon also included Sabang in their itinerary, and besides large quantities of Bengal coal, both companies are importing Burmah rice for local consumption in Acheen, and for trans-shipment, chiefly to Deli.

The most important exports consist of Deli tobacco, nearly one-half of the crop, representing a value of about $8,000,000 gold, being shipped at Sabang in the mail steamers and cargo boats of both of the Dutch lines; the balance still takes the longer route *via* Batavia, Singapore or Penang, at which two latter ports it is loaded by the Holt liners and Norddeutscher Lloyd. Another North Sumatra product, Acheen pepper, which hitherto was exclusively exported *via* the Straits, is also beginning to take the shorter way, *via* Sabang.

Coasting Trade.—As a trans-shipment port it may be expected that Sabang will benefit from the liberal measure recently adopted by the Dutch Government, according to which coasting trade between Sabang and other Netherland Indian ports is allowed to foreign vessels. Whereas in a general way the coasting trade within the Dutch colonies is reserved to the national flag, foreign steamers now enjoy exactly the same rights as Dutch steamers for the trade between Sabang and all other Dutch ports, and *vice versa*.

In regard to general merchandise, as in the case of bunkers, the Sabang company makes inclusive charges in the form of wharfage on goods which cover the entire expenses of a steamer touching at the port for the trans-shipment of merchandise. Thus free from import duties with their annexed impediments of custom-houses, formalities, and officialdom, without any *bar* either natural or physical which could prevent vessels of all nations from availing themselves of its facilities, Sabang, pushed for all it is worth by a private company, may reasonably expect to continue its natural growth as an international coaling station and trans-shipment port. As long as the Dutch Government follows the same liberal policy as in the past and takes the necessary measures to defend the neutrality of the port in time of war the growth of Sabang can only be welcomed by merchants and shipowners, as well as by their respective Governments.

OIL FIELDS OF SAGHALIEN

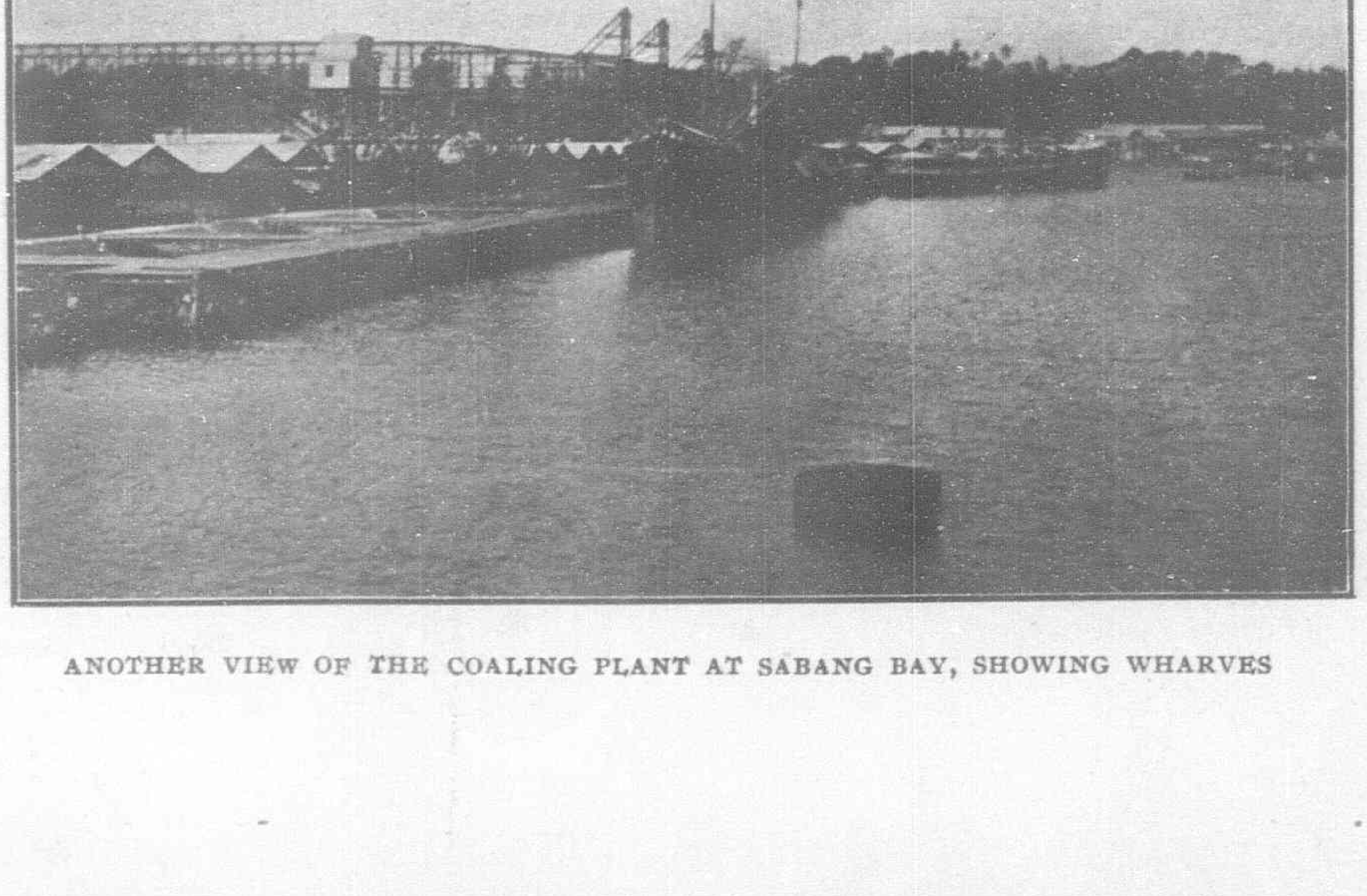
(*Concluded from page 327.*)

be even more extensive than the coal deposits. The existence of petroleum on the island was known to the natives long before it was reported to the Russian Government by an expert in 1894, in which year he discovered rich exusions of it near the Boatassin river. Proceeding a few miles further north, near the river Nutovo, he came upon whole lakes of the precious liquid. One of these lakes, which had a diameter of about eighteen feet, was actually in a state of bubbling upheaval. The other had a hardened surface of bituminous mud due to the evaporation of the oil, and with sufficient resistence to permit walking on it. Some prospectors boring at a point four miles north of the Boatassin river found nearly 30 feet of solidly frozen ground, which in many cases has proved a difficulty.

M. Platonoy, a Russian petroleum expert, sent out by the Baku Manufacturers' Trust, after visiting the Pennsylvania and Texas oil-fields, reached Saghalien in 1893, and upon completing a careful examination of the most promising districts, gave out a very optimistic opinion of the wealth and extent of the Saghalien fields. He even went so far as to state that all he had seen in America was as nothing compared to that which he had seen in Saghalien. M. Platonoy does not hesitate to assert that the petroleum deposits along the Nutuvo river are in all respects superior to those in the Baku region. A quality greatly in favour of the Saghalien oil is that it contains no benzine, and is, therefore, capable of immediate use as fuel. Assiduous efforts are now being put forth by private companies to bring the product of this region upon the market, and the thousands in China and Japan now dependent for their oil supply on Southern Russia and the United States, anxiously await results.

There are, however, some formidable obstacles to be overcome before there can be any profitable development of regions so remote as the oil-fields of Saghalien. Prospecting there at present is at the greatest personal discomfort and at the gravest risk of life itself. The fields are more than three hundred miles from the nearest Russian penal settlement, and the prospector is in constant danger of being murdered by the brodyagi (escaped convicts) that prowl in considerable numbers through those northern wilds, ready to stop at nothing that promises relief to the pangs of hunger. All the workmen employed at the "wells" are themselves convicts, every man of whom has killed a fellow mortal at some time or other in his career, and who could not hesitate to do it again if there was anything to be made out of it. Notwithstanding the danger, numerous prospectors are to be found there, young fellows from England and America, and other countries; and they say that when the *brodyagi* appear, their only safe plan is to shut all the workmen inside the camp, and face the enemy with rifles and revolvers until he is either dead or driven off.

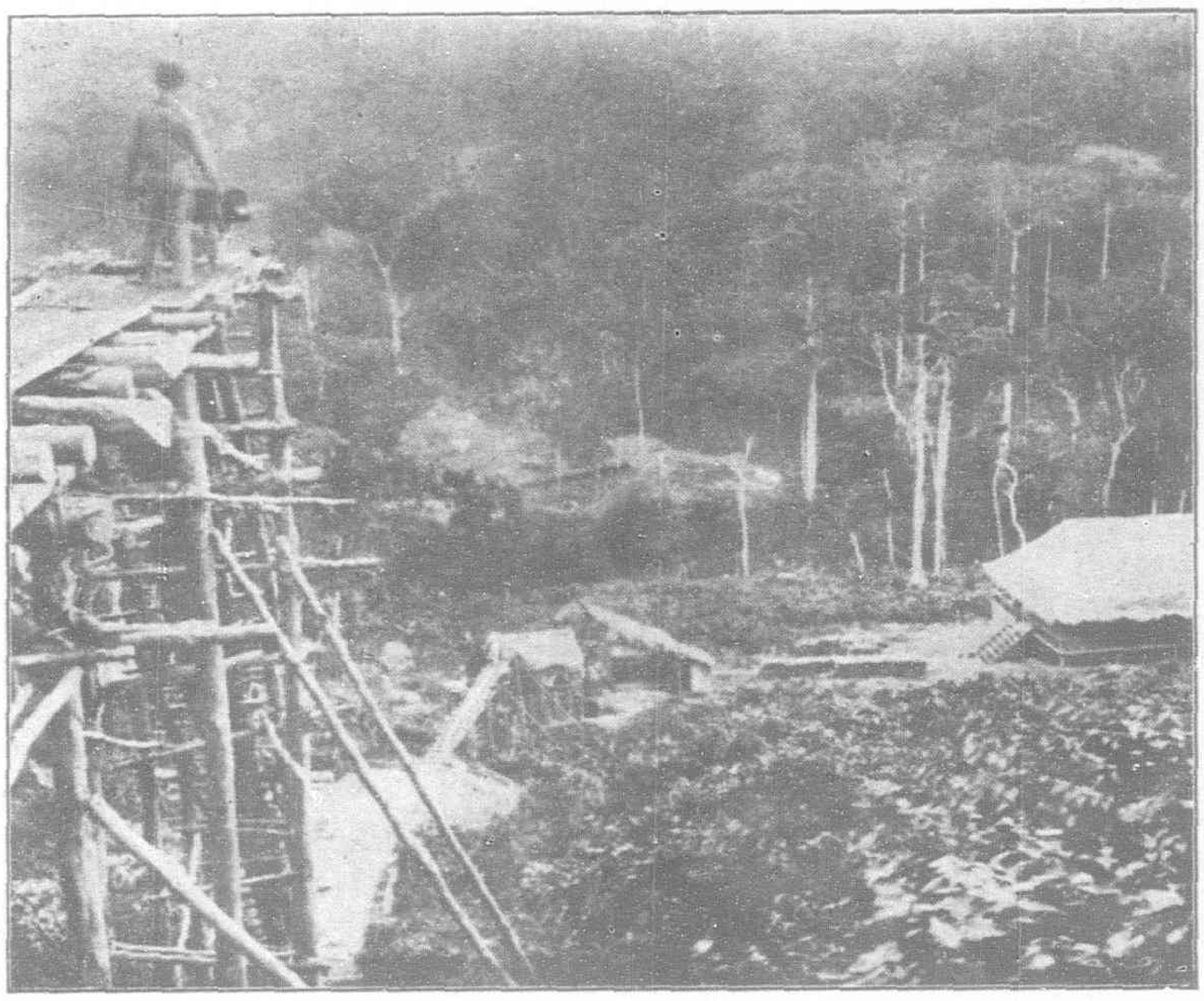
During the winter months the cold is so extreme as to be 40° below zero most of the time, and then all operations have to cease. The usual plan of the prospector is to try to get down to Alexandrovsk before the rivers freeze over. One party had got many miles on the way down, when the frost overtook them, completely closing navigation and compelling them to undertake a dreary journey through impenetrable forests back again to the camp. On their way back they came across a hut in which were found six skeletons reclining in various positions, reminding them of the fate of others passing through that region.



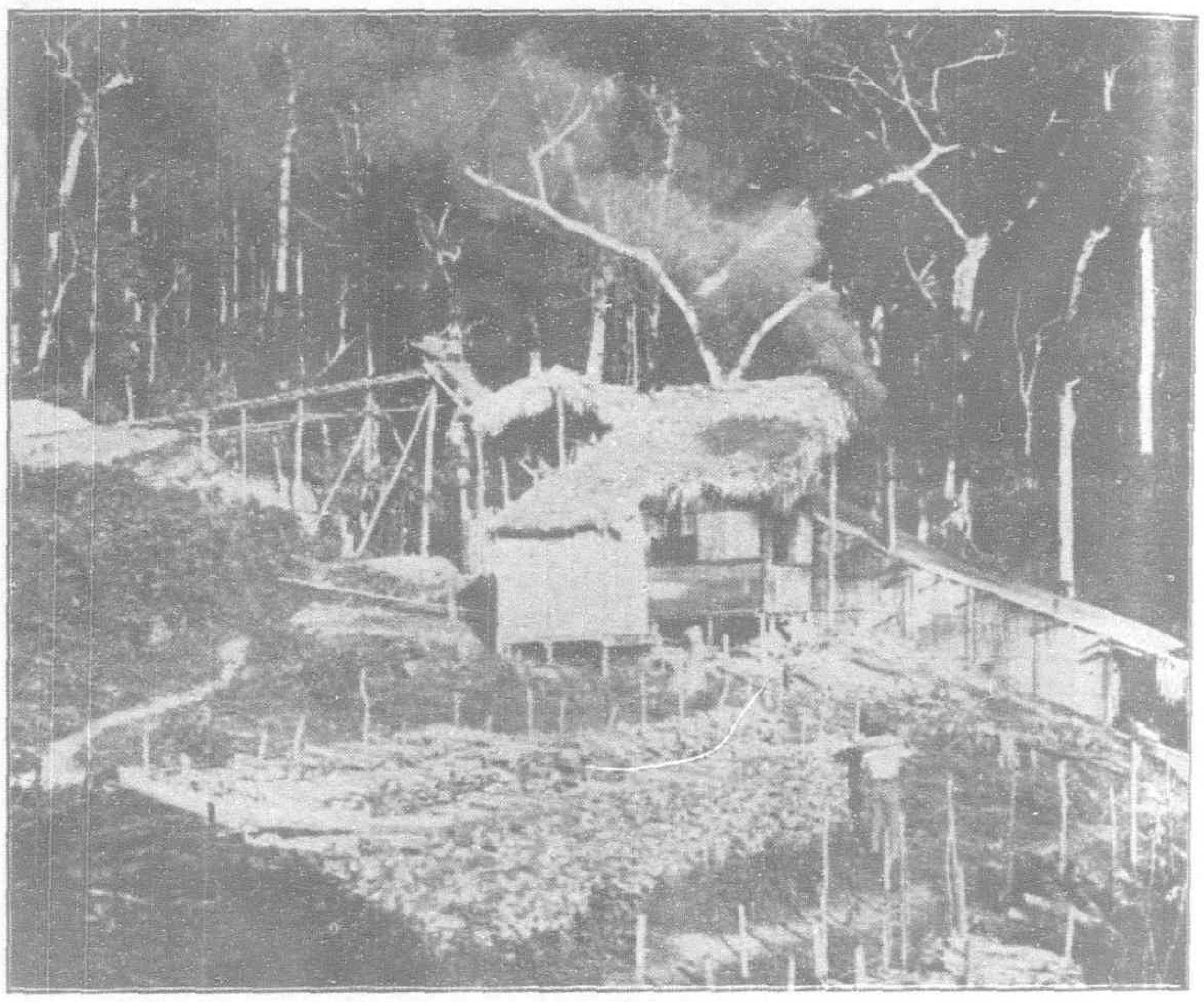
ANOTHER VIEW OF THE COALING PLANT AT SABANG BAY, SHOWING WHARVES

EASTERN MINING COMPANY'S MASBATE WORKINGS

(BY A. J. EVELAND, *Mining Engineer.)*



BIRD'S-EYE VIEW OF EASTERN MINING COMPANY'S CAMP



VIEW OF THE MILL FROM VERANDA OF OFFICE BUILDING

The Aroroy Mining District, on the northastern coast of the island of Masbate, has been probably the most prominent of the mineral areas under exploration since American occupation of the Philippine Islands. The Eastern Mining Company was one of the pioneers in the Philippine field and has been the most prominent concern of the Aroroy region. Its property comprises seventeen lode claims of the following names and sizes:

Name.	*Area.*	
King	22.9568	acres.
Have Got (fraction)	21.5889	"
Nebraska Star	22.9568	"
Holy Moses	22.5310	"
Elise	22.5968	"
Sweetheart	22.5968	"
Mabel (fraction)	22.9005	"
Nancy (fraction)	22.8163	"
Mountain Maid	22.9568	"
Can Do (fraction)	6.0067	"
Never Sweat (fraction)	10.9381	"
Doris (fraction)	12.7339	"
El Dinero	22.5 Appx.	"
El Oro	22.5 "	"
Alice	22.5 "	"
Jessie (fraction)	20.0 "	"
Katherine (fraction)	2.5 "	"

The holders of the first twelve claims named above organized in 1901, and incorporated in 1903, the Eastern Mining Co., of which the Officers are at present as follows:

President - - - - - - - - - - A. Heise.
Vice-Presdt. and Sec. - - - - Geo. Morgan.
Treasurer - - - - - - - - - Gay H. Parsons.

Directors - - - - - - - - A. Heise.
C. H. Parsons.
T. D. Aitken.
W. J. Shaw.
B. H. Berkengotter.
T. M. Devilbliss.

The total area of the property is about 340 acres, all of which has been surveyed, and the first twelve claims named—240 acres in area, are in process of patenting, all the papers having been filed.

The claims are situated on the Guinobatan River, about four miles from the village of Aroroy, which is on the northeast coast of the Island of Masbate.

The Island is, in latitude, centrally situated in the Philippine group, and reached by steamer from Manila, in about 24 hours' run. Aroroy is a village of a few houses, a school, and a post office, of no particular importance except as the port for the mineral region known by the same name. The village is on the south shore of the Porto Barrera, a wide bay which extends almost to the other side of the island. South of the village, on the hills back of the town, is the mineral region, extending to the southeast to a distance not yet known—present operations are confined to the region along the Lanan and Guinabatan rivers, both of which discharge into the Porto Barrera.

Aroroy is the port of call for only one or two steamers, and the direct calls do not average more than two a month. Masbate, however, about thirty miles down the east coast, is the largest and most important town on the Island, and the seat of local government, and here better than weekly calls obtain. From Manila to Aroroy, a distance of 250 miles, the time of passage is from 24 to 40 hours, 30 hours being about the average, tho' bad weather may delay the small steamers to a considerable extent. Masbate is practically the same distance from Manila in point of time. There is a weekly mail service between Masbate and Aroroy, and a gasoline launch is available at Masbate, or at Aroroy, upon notice, for passengers or a few tons of freight.

Quicker passage may sometimes be obtained by going to Sorsogon from Masbate, and catching one of the almost daily steamers from there to Manila, or the reverse trip.

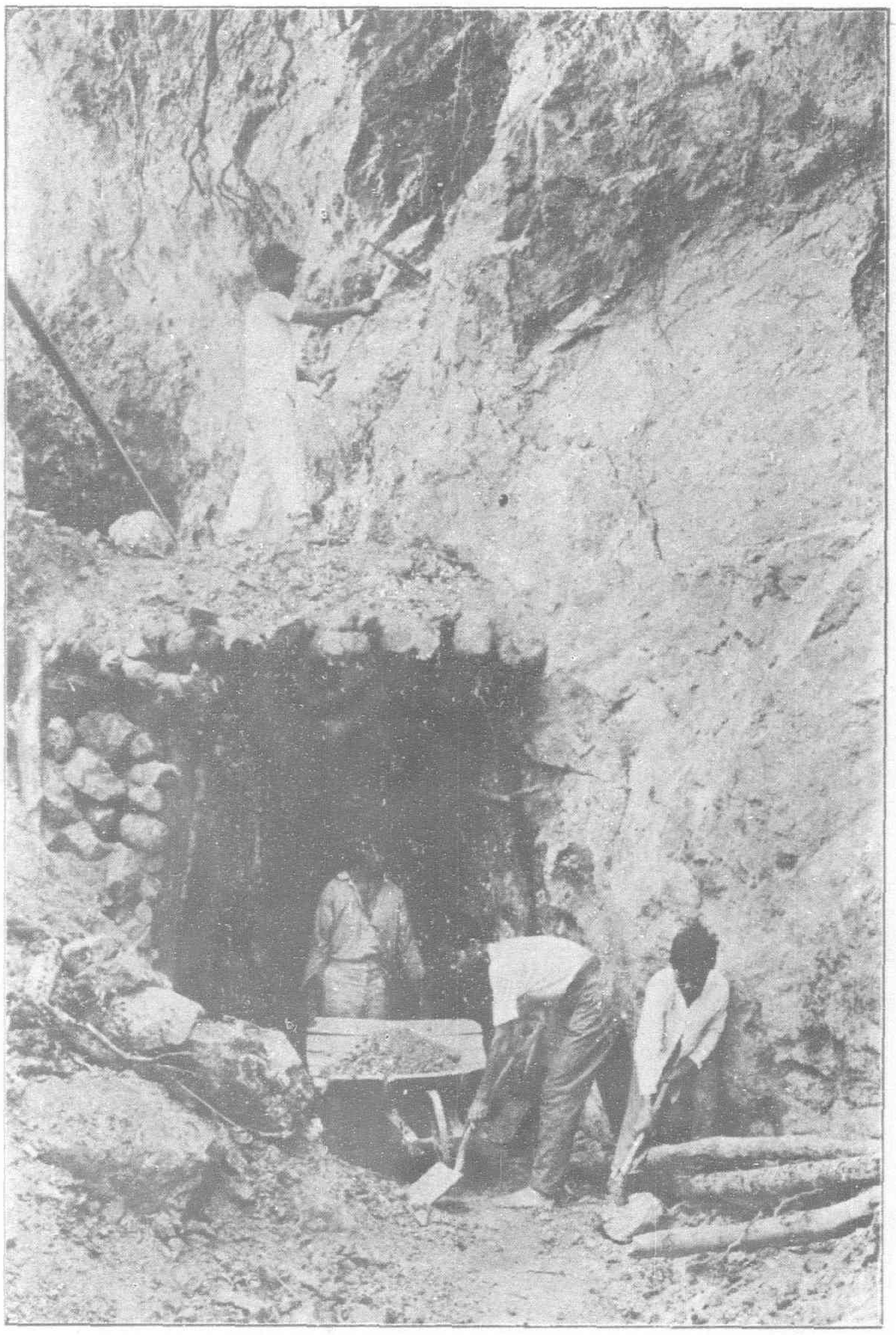
From Aroroy to the Eastern property, there is a horse trail in very poor condition over the first three miles, until the Giunabatan river is reached. For the remaining distance of not more than two miles, the trail follows the river and is in good shape. Over this portion of the trail, a wagon road is being built, which will extend from the Eastern Mining Company's property down the river to the head of tide water on the Guinabatan River. The lower 2 miles of this road has been completed at a very low figure and on its completion, freight may be brought via water around on the Guinabatan River, up to the first camp, which marks the head of the light navigation, and there landed, at a considerably less expense, and in less time, than as now, landing at Aroroy. Cascos can be loaded from the ship's side and can transfer their freight direct to the wharf on the wagon road.

Freight charges are extremely variable—from the best information that could be gathered, the rates from Manila to Aroroy will average four to ten pesos ($2 to $5) U. S. Currency, depending, as usually is the case with water transportation, on the character of the materia space occupied, and weight.

From Aroroy to the mine, all freight is at present packed on carabao at the rate of 0.90 pesos ($0.45 U. S. Currency) per trip. As much as 350 or even 400 pounds may be carried, if not too bulky. From the Guinabatan river landing the rate for carabao packing is 60 cents ($0.30 U. S. Currency) per trip, and at this rate, assuming as an average a three hundred pound pack, the freight rate after leaving the steamer is excessive—six pesos ($3.00 U. S. Currency) per ton from Aroroy to the camp of the Eastern Mining Co., or four pesos ($2.00 U. S. Currency) from the Guinabatan River landing to the camp. The decreased cost in making the landing at the Guinabatan river, during the next year, when large amounts of supplies are coming in, and three mills being erected, will pay for the construction of the wagon road proposed.

Topographically there is nothing either unusual or noteworthy in this region. On account of an unusual rainfall, natural valley erosion has developed on a slightly elevated island mass a system of drainage which gives quite a decided relief to the region, and to the island as a whole. There is a considerable area of lowland flanking the bay, and this is almost entirely open cogon grass land, rolling hills, gentle slopes and with an elevation not exceeding 100 feet. Mount Bagadilla, on the north side of the river, only a thousand feet or so in height, and other ridges and spurs of generally less than that elevation, are typical of the "highland" area, which adjoins the rolling country. Only occasional is an eminence of over six or seven hundred feet—five hundred feet would more nearly represent the average elevation of the highlands. The claims of the Eastern Mining Co., with the exception of the "Mountain Maid" and "Never Sweat," lie on the south side of the Guinabatan, on the north and south sides of a ridge about five hundred feet in elevation, which owes its existence to the quartz leads that form its backbone and have aided in resisting destruction. The ridge has enough height to give several hundred feet of "backs" above the level of milling and has sufficient slopes to facilitate any tram or ropeway construction as well as suitable slopes at mill sides. Drainage takes place rapidly, and is well cut, so that control of the run off is easy.

Road construction will not be attended with any difficulty; there will be no heavy cuts or fills, and bridge work will be small in amount, if care is made in location. Altho' not great, stream profiles, of main streams at least, are sufficient to make easy the constru-



OPEN CUT AND TUNNEL

tion of flumes or ditches, in case more water is desired from distant points.

The island of Masbate represents an igneous basal mass which has recently, geologically, passed through some interesting phases. The island has been submerged, at least once, to a depth of some hundreds of feet, and coal beds have formed on the southern end. Remnants of limestone, formed in Miocene times, cap hills in the vicinity of Aroroy, and their nature indicates formation at considerable depth. During the rise of the island, it is evident that several pauses took place resulting in the formation of beaches, which may be seen on the northside of Porto Barrera, not at a considerable elevation. An intrusion of a very large granite mass, of which Mount Villon is a portion, took place at some uncertain age, and probably was the principal cause of the origin of the ore deposits. There also has been, in a time more recent since the formation of the limestone in the Miocene, lava flows of different kinds, both extrusive, over the surface and in dykes through the basal dioritic mass. Probably these, in common with other districts of the Philippines, were partially, at least, the cause of the formation of ore bodies. The here are more than twenty-five veins, forming a system probably all of more or less connected veins running thru' the basal diorite, of every width, from a few feet to over a hundred; they maintain a very striking regularity for several [illegible]

ally, the ground of the Eastern Mining Co. has the longest dimension of its 330 acres parallel and covering the strikes of a number of these veins, at least fifteen.

There is an excellent stand of native hard and soft wood on these seventeen claims. The timber is of the first quality, and a large proportion of it comes under the "1st Group" in the classification of the Forestry Bureau. Nara, Molave, Apitong, Tamayuan, Toog, Amiguis, and other woods occur in abundance, of first class growth, where they can be dropped within a few feet of the place to be used. These woods have been used underground and in mill and other building construction, and have given satisfaction. There is enough of a stand on the claims to satisfy all wants for some years, and in the immediate vicinity are forests still untouched by the axe. Native labor at 25 cents U. S. Currency per day gets out this timber very cheaply, and sawyers (native) cut it to dimensions at the rate of 10 cents per vara (33 inches), for the usual log sizes up to 18 inches. For 18-25 inch logs, the price is 15 cents (gold) per vara.

Molave can be contracted for at 17½ cents per cu. foot, squared, but even at this low figure, is in excess of day's pay work by timbermen.

There will be no excessive timbering in the ground, however. The walls of the veins so far opened up are firm and stand well.

Fire wood can be delivered on the ground for $2.00 per cord, and there is an abundance of swamp wood of excellent quality.

Owing to customs duties and distance involved in the importation of supplies into Manila, prices are somewhat higher than in the United States. Manila has grown a great deal in the last few years, commercially, and there are large and well stocked firms doing business there. Except for special mining machinery, it is not necessary to go further than Manila to obtain all materials that are needed, and at prices not unreasonable.

The native has been used in this and other mining districts, extensively and successfully, both in surface and underground work. His efficiency is naturally not as great as that of the white man, and yet, when the daily wage and the amount of work done are taken into consideration, it is found that results are excellent. Supervision must be thorough, and the treatment of the men must be more or less paternal. The scale of wage agreed upon to be used through the districts is as follows:

Common labor, not to exceed..................	$0.30	U. S. Currency	per	day.
Underground labor, not to exceed $0.50 to......	0.30	"	"	"
Timbermen Carpenters, etc., not to exceed.....	0.75	"	"	"

With these prices it is understood that the food of the laborer is provided free of cost by the employer. It consists of 3 "chupas" (about 2¼ lbs). of rice and three small fish per day, the whole worth about $.05 to $.07 U. S. Currency. At this wage the Filipino will produce work enough to invite comparison with the results obtained by using more expensive labor. For example, a double hand drill crew of two men, mucking their own direct, will drive a 7×5 ft. drift on an average of 45 ft. per month, or 1½ ft. per day, at a total cost of labor of less than $1.25, or about $0.80 per foot. With proper supervision by white foremen, Filipino crews will be able to make at least 80% headway of any other labor.

As yet, all work underground has been by day's pay, and no data are available for the results or prospects of contract work. In other districts where I have seen it tried, success has been met with, and I see no reason why the very small spark of ambition the Filipino possesses might not be encouraged to the benefit of himself and the operator. Contracts are entered into now for the supply of firewood, timber, and transportation from the coast, and results have been satisfactory.

For all but skilled technical positions, it will be found that Filipinos can be used—they can be trained as drillmen, timbermen, millmen, machinists and firemen, and the only thing needful is supervision by a white man as foreman in each branch of the work.

The supply of labor in Masbate should be sufficient—the island is well populated, and there is only a limited amount of agriculture or other industry to draw them away. Effort should be made to provide suitable homes for the men, and it has been found that if laborers can be induced to settle at the camp with their families, they are much more content. The Eastern Mining Co. has provided homes, a cock-pit, a well equipped store which supplies goods at prices equal to the native "tienda," and has obtained good results from this policy.

There is a marked absence of tropical diseases on this island. Although the region is elevated but slightly, there are few mosquitoes and fever is uncommon. The region is subject to a heavy rainfall annually, 100 to 120 inches, and the dry and wet seasons, which characterize most of the Philippine group, are almost wanting—the rainfall is fairly evenly distributed throughout the year.

Being heavily forested, the region is well protected, and the run-off is under better control than in the open country. The climate will not be found detrimental to the health of white men, even after prolonged residence.

The temperature is lower than that of Manila, of which the yearly average is given by the Weather Bureau as 26°.8 C. or 80.24° F. This figure is obtained from the result of 15 years' observations.

The Guinabatan river will give, at all seasons of the year, plenty of water for mining and milling purposes. Its use in the boiler installed in the year 1904 has produced no bad effects, and there will be no unusual problem involved in bringing it to the mill or boilers.

It is not believed that the Guinabatan River can furnish any power—further search may possibly find enough head and volume for turbine equipment, but it seems hardly probable. With firewood to be cheaply and easily supplied for a good many years, boilers and steam engines will give the most satisfactory equipment. Coal could be brought to the mines very easily

APPROACH TO "HAVE GOT" TUNNEL AND CHUTE

and cheaply, but there will be no necessity for it for some time to come.

For domestic purposes, there is a good flow of pure water within 100 yards of the central camp.

On all the seventeen claims comprising the group, some work has been done to develop the ore bodies. Many of these workings have exposed leads of size and value, and, on the whole, there is a remarkable surface showing over this group.

The veins strike uniformly within a few degrees of Northwest and Southwest, and dip to the Southwest at an average of 70°.

The outcrops on the Elise claim are quartz which pans high (about $15.00) in free gold. Old workings occur to a considerably extent, and it is presumed from good evidence that these were operated by Chinese over a century ago. The other cuts made recently have not progressed sufficiently to more than to assure the presence of a vein, but the line of old dumps and pits continues to the Southeast some 4000 feet; on some of them at least one vein four feet in width is exposed, dipping 65° Southwest, and with a strike of north 45° west, approximately.

The "Jessie and Alice" claims have been recently located, and no work of any importance has been done. A vein of unknown width and value outcrops at the Southeast corner of the "Alice."

On the "Sweetheart," an open cut again shows vein material, strike north 30° west, dip, with a width of six inches, which is probably a stringer paralleling a vein not yet exposed, striking North 35° West, and with a dip of 90°. Not enough work has been done here as yet to warrant sampling.

The "Nancy" and "Mabel" claims show Northwest-Southeast outcrops over a considerable distance, and two tunnels, one on each claim, have been started to test the veins. On the "Mabel" the foot wall assayed $1.65 over a distance of 60 feet, the vein being only broken into at the time of this report, and consequently the width and value of it are not known. The outcrops, however, of the "Mabel," are some of the heaviest in the group, and certainly measure over ten feet. Where one of these veins is believed to come thru on the "Gold Bug" group, the old workings indicate a width of about thirty feet, and the outcrops are the richest in free gold in the district.

The "Never Sweat" on the north side of the Guinabatan river has a high grade vein of unknown width, shown in a 35 foot shaft, from which samples of from $50 to $125 have been reported. An 80 foot tunnel to cross cut this lode has not as yet reached it. This claim and the "Mountain Maid" show apparently the same veins, of about four feet in width, of which no more may be said other than that it pans free gold, and that one assay gave a value of $6.20. Several tunnels and pits have more or less indicated the course of the vein, which is about North 45° West.

The "Holy Moses" shows one vein in a thirty foot tunnel and on the "Catherine" fraction, another outcrop appears.

On the "King" a five foot cut shows quartz carrying free gold and northwest-southwest stringers cross the "King" creek,—southeast of this location. On the "El Dinero," and "El Oro," there are as yet no workings.

The "Doris" has two noteworthy outcrops, a large vein (8 feet) striking northwest and carrying considerable copper sulphides (2.22% copper, $22.28 gold). Southeast of this is a shaft 15 feet deep, sunk on a 6 foot or wider vein, striking North 45° West.

On none of the above claims is enough work done as yet other than to show that numerous veins exist, which show more or less free gold values. The ground has been secured, but most of the active development work has been confined to the "Have Got" and "Nebraska Star" claims. These two claims are the ones where ore exists that can be milled immediately, the other claims, though showing good surface indications must be developed before more than their possibilities can be passed upon. They are, however, to be considered as valuable ground.

On the "Have Got" and "Nebraska Star" claims, there has been, and is now actively going on, considerable development. The work on the "Have Got" consists of an open cut, 177×125× 20 feet in all, which has been worked to supply the five stamp mill installed on this claim. On the southeast side of the shaft mouth in this open cut, the quartz is almost solid clear across the face for 52 feet. As shown on the plat, there seem to be two more clearly defined veins, each 8 feet in width, which have been the scene of old workings, and the easterly one assayed $12.00 per ton. There has been some dislocation here, and it is not certain if the 52 feet of quartz represents one lead, or two connected locally by a stringer system. On the other side on the shaft, the easterly vein (which may be the westerly one faulted to the northeast about 40 feet) is well defined, and the cut west of it is quartz clear thru with no defined wall on that side. Several small slip faces can be seen here and the apparent jumble of veins may be due to any one or more faults on these lines, which development underground will show up. The few faults already noticed have all been small in lateral separation and it is not believed that there will result any complicated lode-hunting underground. The old tunnel here, now caved, is stated to have passed through 10 to 12 feet of veins, as indicated on the map. There are extensive ancient workings for hundreds of feet up the hill from here—shafts, some of them thirty feet deep, tunnels, and pit, which indicate that the vein system here has not been entirely exposed as yet.

On the open cut has been sunk the 6×6 foot "Have Got" shaft, sunk vertically in the hanging wall of the east vein, and cutting it at a depth of thirty feet. The vein has a width of six feet.

From the bottom of the vertical shaft an inclined winze has been sunk on the vein to a depth of 160 feet in all, and a cross cut 215 feet in length on this level connects with the surface. The vein has been drifted on for 70 feet at this level and assayed $8.27 in gold.

The main cross cut here has been caved for some time, due to careless timbering work, but the data regarding it is taken from the report of Mr. H. D. McCaskey, Chief of the Mining Bureau of the Philippine Islands, who inspected the property and others of the region, early in 1906.

The ore from these workings was put thru' a 5-stamp Union Iron Works Mill, driven by a 15 H. P. engine. The mill was entirely unsuitable for such work, and has serious errors of construction, so that it has run only a portion of the time since it was installed.

From its operations, however, the following amount of bullion (taken from the official records at the government assay office) were shipped:

Oz.	*Fineness.*	*Value.*
16	1.733	$240.
11	.687	150.
29	.710	425.
10	.684	155.
1	....	15.
40	.703	588.
2	....	30.
22	.763	350.
5418	.858	965.
18		300.
83	.772	1320.
445	.660	620.

A total of 331 oz., with a value of $5158.00. From the mill return book, the following data are taken:

Sept. 19 to Oct. 11, inclusive. A total of 31 oz. 17 dwts. of amalgam were taken from the plates: at the clean up Oct. 13, 40 oz. 12 dwts. were obtained, a total of 72 oz. 9 dwts., which yielded 15 oz. 18 dwts. of retort metal. The clean up of Sept. 16 gave 25 oz. 11 dwts. of retort metal, and the two added were shipped to Manila, yielding 40 oz. of gold, .703 fine, valued at $588.00.

From April 11 to May 3, inclusive, 114 oz. 6 dwts. were taken from the plates, and 30 oz. 8 dwts. at the clean up, a total of 144 oz. 14 dwts. This, retorted, gave 29 oz. gold (34% of the weight of the amalgam), of a fineness of .710 valued at $425.00.

From May 7 to May 26, inclusive
Plate 66 oz. 8 dwts.
Clean up 27 oz.
Total 95 oz. 8 dwts. amalgam,

with other amalgam, amounting in all to 241 oz.; dwts., it was retorted and gave 28 oz. 14 dwts. of gold.

Run of May 31 to June 26:
Plate 116 oz. 8 dwts.
Clean up 30.
Total 146 oz. 10 dwt.

This amount of amalgam yielded 56 oz. 16 dwt. of gold (or 38.9%); a shipment of 54 oz., .858 fine, value of $965.00. There is no means of estimating the amount of ore put thru except that, as the stamps are 800 lbs. only, and crushing through 60 mesh, and as the mill is extremely poor in design and construction, it could not have been the normal amount per stamp. Delays and stoppages on account of breakage were numerous, and finally cam shafts and bearing gave way putting the mill out of commission. From the percentage of gold in the amalgam, and the amounts obtained in these runs, it is clear that an excellent saving could be made with a well designed and well built mill. The boiler, engine, and various small parts are in good shape, and re-erection can be made at small cost. The iron frame of the old mill, with its antediluvian mortar should be abandoned and replaced by a timber frame and modern mortar box.

On the "Have Got" claim is a large amount of loose material, apparently an old dump from the ancient workings, which runs $9.00 to $12.00 per ton, is well oxidized, and can be handled at a minimum cost. No exact estimate has been made of this, but at a very conservative figure 5000 tons can be handled from the claim immediately. On the "Holy Moses" claim, there is a similar dump which has not been explored.

On the "Nebraska Star" claim are the newest and most important workings. The outcrop of the vein can be traced with reasonable certainty, from the open cut on the "Have Got," to the northeastern end of the "Nebraska Star," and on the latter claim development has been considerable, and is still going on. Several open cuts expose the vein along the northwest and southeast strike and a shaft 40 feet in depth has been sunk on the foot wall. At a vertical depth of 112 feet below this, a cross-cut tunnel has been driven, cutting the lodes, and is being pushed steadily to the southwest across the strike of all the lodes the present length being 250 feet. At this date, four veins have been cut and drifts driven on each both ways from this cross cut. Vein number 1 has been drifted on to the southeast for 180 feet and to the northwest for 110 feet. It has clean cut walls, strikes south 35° east, and dips 700 southwest.

On the north drift, at a distance of forty feet from the cross cut, a fault cut off the vein, but work was carried on, and the vein picked up 12 feet to the northeast, wider and carrying more free gold than before. Vein No. 1 averages 3 ft. 4½ in. in width, southeast of the fault and about 6 feet in width to the north west. Sampling on Vein No. 1, Star Tunnel level, gave an average value of $5.21 (U. S. Currency) over an average width of 3 ft. 6 in. The values are very evenly distributed and on the southwest drift of this vein a slightly higher grade ore shoot comes in which will yield an average of $8.50. The widening out of this vein, the northwest of the fault, is noteworthy, and heavy high grade concentrates are appearing in larger quantity as development progresses.

Vein No. 2, parallel to No. 1 at a distance of 44 feet to the southwest, has been developed for 50 feet on the south and 90 feet on the north sides of the main cross cut. It has a steeper dip (to the southwest) but the same strike as No. 1. It is heavily oxidized and the sampling gave an average of $12.14 to the ton, over a width of 4 feet 3 in. In common with No. 1 it has beautifully regular walls and even distribution of values.

Vein No. 3 has been drifted on for 35 feet on the north side and for 20 feet to the south of the cross cut. Its strike is that of No. 1 and No. 2 and in width it averages 4 feet 6 inches. It will average about the same in value as No. 1 and No. 2.

No. 4 vein parallels the first three again at a distance of ten feet to the southwest. Assays of $18.29 per ton were obtained from the development of 25 feet on the southeast side of the cross cut.

A shaft has been sunk on the No. 1 vein to the cross cut, meeting it over the junction of the cross cut and the drifts on the vein. Sampling of it gave assays ranging from $14.50 on the surface ores, to $6.00 at the No. 1 vein level, indicating the even tenor of that vein. The vein in the shaft averages about 4 feet in width. This shaft gives excellent air connection for the lower workings and proves up the No. 1 vein finely, in connection with the underground and surface work.

Only a small amount of work has been done at a lower depth. A second level has been started on No. 1 vein, the opening being made from a gully a few hundred yards to the southeast.

The character of the ore in these veins and workings is uniform, a hard vitreous quartz, showing banded structure, well oxidized at the lower levels, and carrying concentrates of higher grades in the form of iron pyrite.

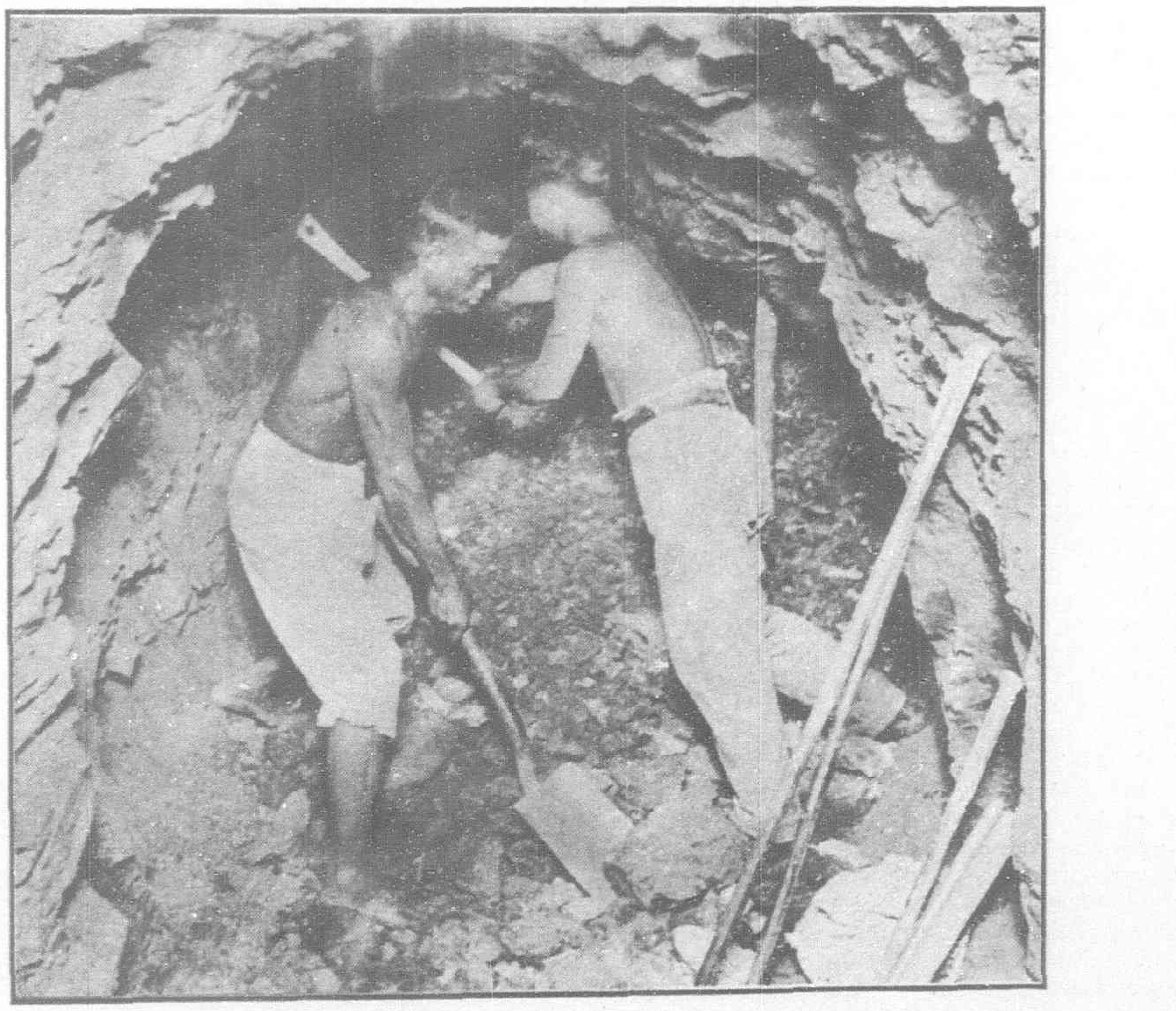
There is hardly a way of estimating the quantity of ore available in the "Have Got" workings, except that the open cut could supply a large amount immediately. The old dump on the "Have Got" contains under foot at least 5000 tons, ready for immediate treatment, valued at $10.00 per ton.

Vein No. 1 of the Star has been proved up on three sides on the north side and on four sides on the south side of the cross cut, and it is estimated that there is a body of ore here 300 feet long by 3.38 feet wide by 125 feet depth, or about 130,000 cubic feet. Tests have given the number of cubic feet to a ton of this ore as 13, and this gives a result of about 10,000 tons of ore, valued at $5.21 per ton in the vein No. 1, "which may reasonably be supposed to exist," from the careful sampling and development.

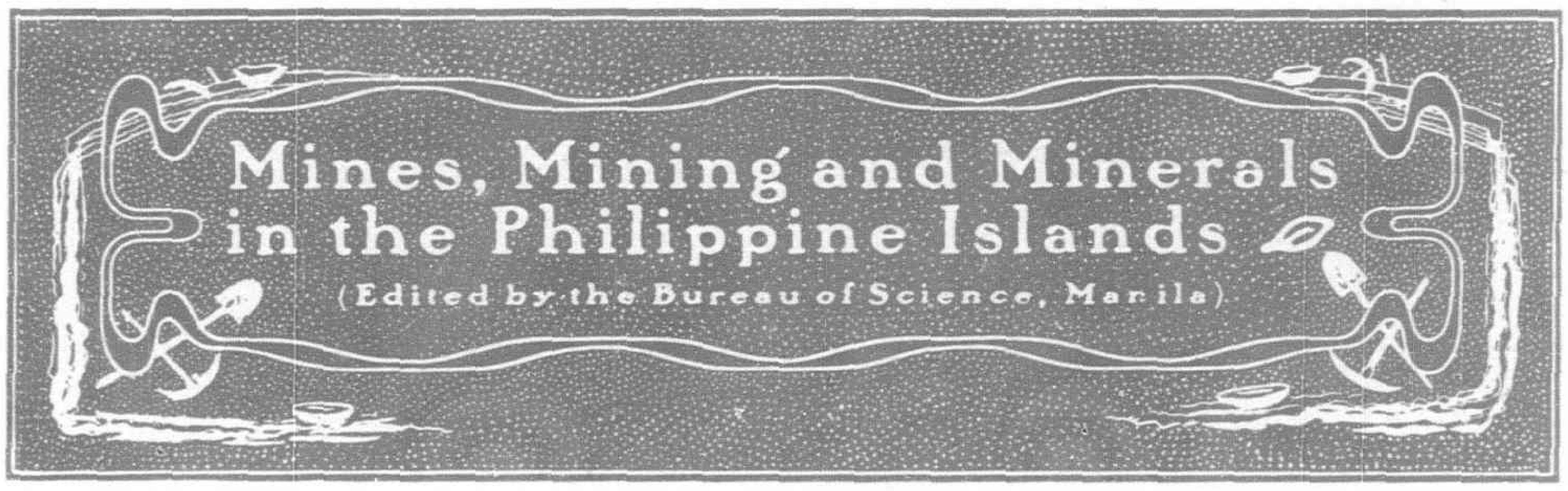
Veins Nos. 2, 3 and 4 cannot yet be figured on as they have not been developed. It will be only a few months' work to prove up these ore bodies by upraises and drifts, and development of ore will proceed more rapidly now that the first levels and crosscuts are completed. It is particularly difficult to place any value on a property in such a state of development as this, but the total of $100,000.00 exposed ready for immediate milling should be enough to warrant the construction of development work and the installation of a mill.

From tests made on these ores, it is found that outside of the old dumps, and the surface ores, only about 25% of the value will be free milling. There is present a variable percentage of concentrates, almost entirely iron and it will be necessary to concentrate and cyanide. The ores show no indication of becoming more basic, and probably there will be two hundred feet more in depth of partially free milling ores; no elements detrimental to cyaniding have been observed in these veins, and tests show that an extraction of over 90% may be made.

Although but few figures are available for the cost of operation of mines, mills and of ore treatment, under the conditions in the Philippines, it can be safely said that $5.00 ore can be handled on this property at a profit and anything above that will be clear gain. There are no difficulties locally in the way of economic handling of material, in fact conditions on the ground may be considered almost ideal for operation on a large scale, when extent and value are proven. Labor, water, fuel, timber, character of ore, "lay" of the lodes, etc., are all most encouraging in aspect and from surface development over a large area, it would appear that there is to be expected large, regular ore bodies. Treatment will be comparatively simple, and transportation of supplies can be done cheaply.



NATIVE MINERS AT WORK AFTER A BLAST ON "SWEETHEART' CLAIM



Mines, Mining and Minerals in the Philippine Islands

(Edited by the Bureau of Science, Manila).

[*A regular feature of* THE FAR EASTERN REVIEW *hereafter will be this department, which we expect to prove of general interest and value, especially to the miners of the Philippine Islands. It will contain a variety of reliable articles, observations and notes concerning the minerals of the archipelago, their development, observations on the mining situation, reports on the progress of development work by private interests, notes of a personal nature dealing with the movements and doings of the miners, and a fund of other useful information, all of which is expected in a small way at least to help along mining enterprise. In order to give special weight to the department, as regards accuracy, etc., we have arranged with the Director of the Bureau of Science to have the matter edited by the Chief of the Division of Mines.*—EDITOR'S NOTE.]

In the northeastern-most part of Luzon there is a district bounded on the west by the China Sea, on the east by the Caraballo del Norte Range, and on the north by the Formosa Straits, which bids in time to become a very rich mineral region, and this district will probably be known not for its gold or copper, though there is undoubtedly some of each of these minerals, but through its non-metallic minerals: asbestos, phosphate, mica; and, in all likelihood, it will yield gem minerals Ilocos Norte is mountainous over most of its territory. These mountains are very high along its eastern boundary between Cagayan and Ilocos Norte, with considerable foothill country to the west and a coastal plain varying from 1 to 7 miles in width, being a very irregular strip. The Caraballo range trends north and south and, likewise, the minor ranges to the west, with, of course, occasional exceptions here and there, spurs and offshoots, which tend to have an east and west trend, the most notable case being the long black range running eastward from Cape Bojeador. The mountains of that part explored by me are not high, 2,000′ being the limit, but the relief is quite pronounced, In reality there is a plateau of this height which extends from Pasuquin northeast to Bangui. This plateau though not over 2,000′ high is deeply cut by several rivers, thus giving a pronounced relief to the topography. The principal rivers are the Laoag and the Bacarra, flowing west into the China Sea, and the Bamban northward into Formosa Straits, near Bangui. None of these rivers are navigable for large craft, and the Laoag is the only one large enough even for *Virays.*

Good harbors are scarce on this coast. In the typhoon season it is very dangerous, there being no entirely safe shelter on the whole west coast north of Subig Bay. In all ordinary weather good anchorage may be found in Bangui Bay during the southwest monsoon. In the northeast monsoon the north coast is out of the question. Of the harbors on the west coast there are only three which are used, the Dirique, Currimao and Salamague, the last named the best. All of these are reef-bound and have to be entered with the greatest caution.

The climate of Ilocos Norte is considered very healthy, being much cooler here than in most coast provinces, and its seasons are quite regular. In the time of the northeast monsoon the north coast is very windy and cool. During this season the city of Laoag, capital of the province, is very healthful and pleasant to live in. The word Laoag in the Ilocano dialect means blue skies.

Geologically the province of Ilocos Norte is quite distinct from any other I have been in or of which I have any data. It is distinctly a metamorphic area, and so similar in many ways to areas in the California coast range that anyone familiar with the latter could very easily persuade himself that he was really not in the Philippines at all, but wandering over the hills near Berkeley (Cal.). A simple statement of the formations in the order of their probable position will be sufficient in an article of this kind. From above downward we find the following formations: Raised coral reefs, marl beds, these two belonging to the Pleistocene; calcareous sandstone, coarse-grained sandstone, a brecciated jasper formation, then follows an unconformity, below which are eruptive conglomerates and tuff deposits, granulite dikes; bordering the eruptive conglomerates and the granulite is a belt of schistose rocks; the basal formation of the whole district is a dark, fine grained, in places slightly porphyritic, igneous rock, which for purposes of convenience we shall call a dolerite.

The asbestos deposits occur in the last named formation, the manganese as veins in the eruptive conglomerate formation. In the schistose rocks are found various minor products, namely, micas and talc, which may prove of future value.

It is not to be understood from this enumeration of formations that the whole succession is to be found continuous over the whole area. Indeed, uplift, folding and subsequent degradations have wrought great havoc in the stratigraphic column, and it is only by piecing together bits of information here and there that we have been able to reconstruct a record of the probable past events.

Mineral Resources.—Not until within the last year or two has any systematic prospecting been done in this province and only within the last year has any development work been carried on. And to my knowledge no geologist or mining engineer had ever visited this region previous to this time. It was long known, however, to Señor Lallave, who owns several large estates near Bengui, that mineral fibre existed on his land, though he never fully appreciated the fact. The deposits which are being developed there now and which may prove very valuable assets to the province are as follows:

Asbestos.
Manganese.
Granite—building stone.
Mica and talc.
Felspar and quartz deposits.
Mineral paint—ochre.
Apatite.

Besides these there are remote possibilities of gem minerals being found. There have been found also some poor specimens of opal; also the indications appear good for the discovery of tin.

Asbestos.—As yet no 1st-grade asbestos, or chrysotile, has been found in workable quantities though there is every reason that such will be obtained after more development work. Owing to an erroneous and entirely misleading quotation purporting to have come from the Bureau of Science and appearing in one of the Manila dailies, and quoted in this paper, inquiries have been coming into us from several European countries. To straighten out the matter I shall quote from my report (at that time confidential), to the Chief of the Division of Mines:

> At present I have to say that while there is not one ton of asbestos in sight (I am using this in the sense understood by engineers) in the whole region visited by me, the indications, moreover, seem quite good for getting out in time a fair grade of asbestos and in goodly quantities.

The variety which is being taken out now is the amphibole anhophyllite and tremolite, and is characterized by having its fibres parallel to the walls of the vein. These fibres vary from a fraction of an inch in length to a foot or more. They vary also in color, from a dirty yellow to silky white, and in hardness also. On the Dungan-Dungan Estate, in an estero of the Baruyen River, one finds the nearest approach to the chrysotile asbestos but there the fibre is irregular, being found in pockets and along shear zones in the serpentine. It is unfortunate that at the time of my visit floods and land slides had almost completely obliterated the work Mr. Burdette had done at this locality.

Indications of asbestos have been found at the following localities:

Baruyen Hill—schist area.
Baruyen Valley.
Dungan-Dungan—serpentine.
Baruyen Valley—very promising.
Caraon River—schist area.
Near Pasuquin.
Dalumat.
Near Pasuquin—schist area.

In the most prominent asbestos regions, as the Thetford, Canada, the serpentine areas have been proved to be the most productive and besides are more easily worked.

Manganese.—Manganese, in the form of the oxide, pyrolusite, often mixed with limonite, has been found in a rather limited area adjacent to the barrio of Nagpartian. We find these in its most typical occurrence. All that I have yet seen comes from an *eruptive conglomerate* mass, which forms prominent black ridges on the north coast and about two miles south of Nagpartian. The manganese had its origin in small veins and pockets between the igneous boulders of the mass, but has since been concentrated by natural processes and where it is being opened up now is found as a *blanket* deposit consisting of entirely loose, more or less rounded nodules in a matrix of very red, ferruginous soil.

As to the workable quantity of this ore we cannot as yet predict. The surface indications are quite wide spread, for wherever one goes over this eruptive mass he will find these pyrolusite nodules scattered over the surface.

At present one company is opening up a small surface deposit between two limestone hills about ¼ mile from Pt. Negra, where if the deposit prove to be of any extent and depth there will be no difficulty in getting it aboard ship.—WARREN D. SMITH.

MINERALS OF MARINDUQUE

Mr. Maurice Goodman, of the Division of Mines, Bureau of Science, recently returned from a short trip to the Island of Marinduque, where he made a hasty geological reconnaissance. He reports that while prospecting has thus far been undertaken by but two or three parties, and although mining in any form has not yet begun, the field, although small, is a promising one. Among the important minerals which he encountered were gold, argentiferous galena, chalcocite, malachite, azurite and red hematite. Natural gas and several deposits of bat guano were also observed. Very fine specimens of chalcocite and galena float were discovered, but a search for their source proved unsuccessful in the limited time at his disposal.

EXPERIMENTS WITH TALC

Mr. George Richmond, of the Chemical Division, has been experimenting lately with some talc brought, from Ilocos Norte by Mr. Smith, and he finds that much of this material compares very closely with the commercial substance known as Agalite. Agalite, or fibrous talc as it is commercially known, is extensively used in the manufacture of paper. Like asbestos, it has a distinct fibrous structure, which property causes it to blend well with the vegetable fibers of paper pulp and admits of its retention in paper without the great loss which accompanies the use of sulphate of lime, China clay, and other mineral loading materials.

According to the statistics of the New York State Geological Survey for 1905, there were produced 67,000 short tons of fibrous talc, valued at $469,000, an average of $7 per ton. Practically the entire output of this material finds its way to the paper mills. Judged by physical properties of the Ilocos Norte substance, it would be considered a very good quality for the above mentioned purpose. It grinds well, it is of a good color, and is especially free from grit. Analyses of the Ilocos Norte material, and the standard agalite are given below.

	Specimen examined.	*Agal'te.*
Water (loss on ignition).....	2.33 %	2.67 %
Silica (SiO_2)...................	57.62 ,,	61.82 ,,
Alumina (Al_2O_3)...........	1.36 ,,	1.59 ,,
Iron (Fe_2O_3)................	1.66 ,,	
Lime (CaO)	13.38 ,,	3.65 ,,
Magnesia (MgO)	24.18 ,,	29.98 ,,
Specific Gravity..............	2.84 ,,	2.628

INVESTIGATIONS

Mr. W. D. Smith has just returned from Cebu where he spent two and one-half months making a geological map of about thirty-seven (37) square miles of territory comprising the Compostela-Danao-Carmen Coal Fields, and the Acsubing Lead Deposits. In the latter part of the work Mr. Goodman coöperated. The topographic base map for this work was executed by Messrs. Goodman and Ickis.

Mr. M. Goodman spent the month of January in the Island of Marinduque, investigating the lead and other deposits on that Island. A full report of this work will be given in the next number of this Department.

Mr. Ickis has left for the Paracale and Mambulao districts, Camarines, to make a preliminary examination of the gold fields, and to obtain data regarding the operation of the new dredge, recently installed by a New Zealand Company.

Mr. Richmond, of the Chemical Division, is at present engaged in an investigation of the adaptability of the Ilocos Norte mica and talc for use as loading materials in paper making.

Dr. Cox, of the Chemical Division, is conducting a very complete investigation of the black sands of the Philippines, along lines similar to those employed by Dr. Day of the Geological Survey.

Mr. Henry Ferguson has sailed from San Francisco for Manila. Mr. Ferguson, who was formerly connected with the Cleveland Cliffs Iron Co, Mich., comes to fill the vacancy created by the resignation of Mr. A. J. Eveland.

PERSONALS

Mr. A. J. Eveland, Manager of the Eastern Mining Company, is now Manila in the interests of his Company.

Mr. Benjamin Smith Lyman, the Pennsylvania coal expert, who has been in Cebu for some months past, is, we regret to report, very ill in the city of Cebu, but from our last communication we learn that he was somewhat improved.

Mr. W. A. Kissam, Manager for the syndicate which has taken over the Compostela-Camansi Coal Fields, has returned from Hongkong with his family from the United States. D. M. Carman, of the same Company, has come to Cebu.

Mr. Curran has gone to Ilocos Norte to look into the asbestos properties in the vicinity of Nagpartian and Bangui.

CROSSING SIBERIA BY RAIL

(Concluded from page 315.)

unt of water-borne freight is limited, The s, both by river and canal, on account of short open season, are very high. The t important rivers are the Om, the Irtysh, Ob, and the Yenisei—the two latter being nected by a canal which joins Tiumen and Irkutsk. Carts are generally used for transport, carrying large loads over almost impassable roads.

The border range of Siberia—the Urals—is low and well wooded, and falls away gradually into the steppes, which are unvaried save for forests of birch and fir, until the foothills of the mountains which surround Lake Baikal are reached. Thenceforward the country is rugged and grades considerably, until the Chingan Mountains are succeeded by the rolling grass country of northern Hei Lung Chang. While the miles of steppes showed only occasional signs of cultivation, a patch here and there or a little clearing in the brush, the country about Irkutsk is much more thoroughly settled; there are well-tilled fields, and the villages look more prosperous than those of central Siberia. Beyond Baikal, also, wheat and barley are grown in the valleys; but from Tchita to the east there are few signs of habitation, and the district between Manchuria station and Harbin is bare and wind swept, and almost untouched by the farmer. Around Harbin, however, the land yields a large annual crop.

Harbin and Its Flour Mills.—Harbin, the most important city in Northwest Manchuria, is divided into nine parts—the administration, military, hospital, manufacturing, river, railway, old, new, and Chinese towns. The hospital town, however, is chiefly composed of barracks, and in the manufacturing town there is very little manufacturing. The flour mills are in the river town; they are fairly large, prosperous, and in most cases are adding to their plants. At present they are operated by steam power; but it is proposed to experiment with water power as well. Their machinery is almost entirely from Zurich; but some of the small pieces are made in Moscow. Grain is delivered to them at 40 kopecks (kopeck, one-half cent) per pud (36 pounds), and the flour sold at 1 ruble (ruble, 51½ cents) 90 kopecks, 1 ruble 80 kopecks, 1 ruble 65 kopecks, and 1 ruble 40 kopecks, per pud, according to the quality. The largest has a capacity of 3,000 puds per day, but this will be more than doubled when the additions are completed. American flour is still popular with the Chinese, but owing to the low cost of the native product it is being supplanted by degrees. Harbin is a distinctly Russian town; cabmen, waiters, and servants are white rather than Chinese.

South of Harbin the agricultural implements are even more primitive than in Siberia itself; but, as the country is extraordinarily fertile, the crops are large. The chief grain is kaoliang, a sorghum millet, which grows to a great height and which the natives use for flour and fodder. Beans form the other staple, there being little else except garden truck. The mineral wealth is entirely unexploited, with the exception of the coal mines at Fushun, which the Japanese work in a small way, and some coal deposits near Tiehling, which the Chinese are said to be working. The quality of coal from the Fushun mine is not very good, being filled with shale.

Trade Opportunities.—The most apparent need of Siberia and Manchuria is agricultural machinery. The territories are sparsely settled, and the areas capable of cultivation are great. Agricultural schools have been established at several places in Siberia, and a certain number of steam plows, reapers, and similar implements are now in use, but the field has never been thoroughly canvassed. At the large towns electric plants are in operation, which, with the general use of the telephone and the telegraph, show that there should be a demand for electrical machinery.

To secure a supply of pure water, artesian wells have been drilled at some places, and the sale of apparatus for this purpose, windmills for the isolated farmers, and filters should find a ready market, while the demand for mineral waters might be supplied by the exploitation of the numerous mineral springs. Foreign canned goods are used to a considerable extent in Siberia, although they must compete with the native article.

The sale of woolens, cottons, dust (automobile) glasses, cheap boots and shoes, cutlery, tools, axes, and lanterns would be increased by establishing closer relations with the local markets. In a few places there are grain elevators; but they are neither large nor numerous enough to handle the crops. The investor, in partnership with a Russian, whose presence is necessary in order to represent the business with the administration and railroad officials should find this also a source of profit.

(Continued on page 338.)

HEMP STATISTICS, MARCH 1st, 1907

(Courtesy of C. N. NICHOLSON, *Secretary Manila Chamber of Commerce.)*

Arrivals of hemp at Manila up to 28 February.....................		100,209 *Bales.*
Arrivals of hemp at Cebú up to 28 February........................		33,396 "
Arrivals of hemp at all parts up to 28 February....................		133,605 *Bales.*
Stocks on hand in Manila and Cebú, on 1st January 1907............		63,432 *Bales.*
TOTAL..		197,037 *Bales.*
Exports to all parts to date 28-2-07...............................	108,634 *Bales.*	
Local consumption estimated at....................................	800 "	109,434 *Bales.*
Total stocks at Manila and Cebú on 1st March 1907.............		87,603 *Bales.*

PHILIPPINE HEMP MARKET, FEBRUARY, 1907,

Date	*Vessel*	*London*	*L'pool.*	*Atlantic U. S. A.*	*Pacific California*	*East & Australia*	*Other pts.*	*Total Bales*
	Fwd:—	26,198	9,276	20,001	2,600	400	3,700	62,175
Feb. 1	Rubi..............	3,350	50	....	....	....	800	4,200
" "	Loongsang.........	950	1,350	....	....	....	798	3,098
" 5	Tsinan...........	......	....	....	....	....	68	68
" 8	Yuensang..........	......	....	....	....	....	350	350
" 9	Zafiro	......	....	....	....	....	100	100
" "	Hinchaw, Cebú....	......	....	....	....	....	130	130
" "	Wray Castle, Cebú..	......	....	6,295	....	....	....	6,295
" 15	Loongsang........	......	....	....	....	....	107	107
" "	Kumano Maru......	......	....	....	....	....	567	567
" 16	Rubi..............	1,000	....	....	....	....	500	1,500
" 17	Euphrates.........	3,833	....	....	....	....	500	4,333
" "	Tremont...........	......	....	....	400	....	100	500
" 18	Kaifong, Cebu.....	......	....	....	....	....	35	35
" "	C. Lopez y Lopez ..	3,125	....	....	....	....	....	3,125
" 20	Schuy I. Hill.......	......	....	6,200	....	....	....	6,200
" 25	Nikko Maru........	......	....	....	....	80	....	80
" 26	Antilochus.........	10,504	4,417	....	....	....	850	15,771
	TOTAL.................	48,960	15,093	32,496	3,000	480	8,605	108,634

FAR EASTERN ENGINEERING, CONSTRUCTION, COMMERCIAL AND FINANCIAL NEWS

ELECTRIC RAILWAYS, LIGHTING, POWER, ETC.

Osaka Electric Light Company.—This company has decided to increase its present capital of -Y-4,000,000 to -Y-15,000,000.

Pyengyang-Chinnampo Railway.—The latest announcement about this line is that the Japanese are organizing a private company to build an electric road between the two places. The estimated expense will be -Y-1,800,000.

Electric Tramway, Kiangmoon, South China.—Mr. Ip Yan, manager of the Wa Yek Company, Hongkong, proposes to start an electric tramway company at Kiangmoon, with a capital of $1,200,000 Mexican currency, and has asked for a concession to this end.

Yokohama Electric Railway.—Mr. Yasuda Zenjiro has purchased more than half the shares of the Yokohama Electric Railway and is trying to buy up those yet outstanding. The millionaire's object is to extend the present line as far as Nagoya along the Tokaido, and thence to Osaka *via* Ise, while another line will be laid between Nagoya and Kyoto. The estimated cost of the undertaking reaches the gigantic figures of -Y-70,000,000.

Fort McKinley Lighting System, P. I.—Messrs. Germann & Co., of Manila, have secured the contract from the War Department for the installation of a complete electric-lighting system at Fort McKinley, the great military reservation near Manila. Their bid was $47,990 gold. Other bids were offered as follows:—Messrs. Castle Bros.-Wolf & Sons, $48,960; Messrs. Grant & Co., $61,448, and the Bryan-Landon Company, $47,600. The last-named firm was the lowest bidder but there was a flaw in its bid which caused it to be turned down.

RAILWAYS AND RAILWAY SUPPLIES

Kiangsu Provincial Railway. The first section of the provincial railway from Shanghai to Hsiakow has been inaugurated, and construction is expected to proceed without interruption.

Kiangsi Railway.—A draft contract of a loan of Tls. 4,000,000 from Belgium for the Nanchang-Kiukiang Railway has been sent to the Ministry of Posts and Communications at Peking for approval by the Director-General of the line.

Kaifengfu-Loyang Railway.—This railway in Honan is divided into two parts—eastern and western—the eastern being from Chenchow to Kaifengfu and the western from Chenchowfu to Loyangfu. The eastern section is reported completed and the western to be about ready to be opened.

Canton-Amoy Line.—The survey of the railway from Canton to Amoy—the Kuang-Hsia line—is in progress. It will traverse eastward from Canton through Polo, Kuishan, the Haifeng, Lufeng, Hweilai and Kiehyang prefectures, to Ch'aochou-fu, and from there through the Haiyang and Jaop'ing prefectures in Fukien, and so on to Amoy.

Fokien Province Railways.—Cheng Pao-seng, a Chinese railway official, has been touring the Straits Settlements, the Federated Malay States, Rangoon and Java, of late, collecting money for railways in Fokien Province, China. Singapore Chinese alone subscribed 100,000 fully paid £1 shares. The scrip bears interest, immediately, at the rate of 6 per cent *per annum*.

Szechuan-Hankow Railway.—The British and Chinese Corporation has offered to find funds for the construction and equipment of the Szechuan-Hankow Railway, which would be the first section of the Szechuan-Tibet line. The gentry and student class are, as usual, opposing the proposal, and are sending representatives to Peking to fight any agreement to this end.

Railway Construction in China.—China at the moment, says *The Peking and Tientsin Times*, has many railway schemes, most of which are being watched with interest. Few, if any, however, will come to anything without the assistance of foreign capital. A loan of Tls. 1,000,000 is now being negotiated with a foreign firm for the Kiukiang-Nanchang line, with every prospect of success.

Yuet Han (China) Railway Company.—The President and Vice-President of this enterprise have been denounced to the Throne for conspiracy and corruption. They are accused of the crime of making use of the monies of the company through the names of accomplices and "instruments." They are also blamed for jeopardizing the future success of the railway. The Throne has ordered a thorough investigation of the charges.

Yuet-Han Railway.—A Canton telegram declares that the Mercantile Administration of the Kwangtung Section of the Yuet-Han Railway recently sent a message to the Viceroy of the Province asking him to come from Macao where he was staying and "save the railway from collapse." The message added that the contractor who undertook to reclaim for the company certain portions of the foreshore has, after borrowing large sums and ceasing work, been handed over to the Namhoi magistrate to be dealt with according to law.

Peking-Hankow Railway.—The present available stock of freight cars on this line is inadequate to cope with the traffic, especially from the Province of Honan, which is pouring its produce into the Yangtsze Valley for shipment at Hankow. An excellent bituminous coal is found in the District of Liu-Cheng Hsien, near the Ching-Huan Railway. The colliery is joint foreign and Chinese worked, and coal from it can be laid down by rail in Peking at $9 Mexican per ton. A new line is now being constructed which is to link up the Province of Shensi with the Ching-Huan Railway at Chengchou, while another is being proceeded with which will tap the rich mineral fields of Shensi, and act as a feeder to the Cheng-Huan Railway. It is expected that it will be completed this year.

South Manchurian Railway Company.—The *Kobé Herald* announces the appointment of the following directory of the South Manchurian Railway Company:—Messrs. Kunizawa Shinbei, Kiyono Chotaro, Kubota Katsumi, Inudzuka Shintaro, Tanaka Seijiro and Nonomura Kingoro. Mr. Nakamura Jeko, Director of the Financial and General Affairs Bureau of the Formosan Government, has been appointed Vice-president of the company, and Mr, Kimigewa has the appointment of Chief Engineer. The matter relating to the allotment to the shareholders of 200,000 shares, the company's first issue, and the first payment on the shares, have been duly completed. Five hundred thousand shares have been allotted to the Japanese Government as representing the amount of -Y-100,000,000, the Government's share of the capital. The interest on the sums deposited as security in connection with the application for shares have reached -Y-1,170,810. This sum will become a part of the company's finances.

Chinese Railway Directors-General.—Prior to the formation of the Ministry of Posts and Communications, at Peking, H. E. Tang Shao-yi was Director-General of the Peking-Hankow Railway, the Peking-Kalgan Railway, the Shanghai Railway, and the Imperial Railways of North China, the latter running from Peking to Shanhaikuan and thence to Newchwang in one direction and Hsinmintun in another. Since his admission into the Ministry of Posts and Communications as Senior Vice-President, his office as Director General was abolished and the railways above-named were put under the immediate control of the ministry. On the recommendation of the ministry the Peking Government is going to appoint a Director-General to each of the four railways in question, to be under the supervision of the President and the two Vice-Presidents of the same ministry. These Directors-General are each to be assisted by a Director selected by the ministry with the approval of the Government.

Kowloon-Canton Railway.—Construction work in the New Territory of Hongkong is being pushed ahead as rapidly as possible on this line, according to the *China Mail*. The roadbed is now almost continuous between Fan Ling and a point near the Chinese border, except for numerous bridges and culverts that will be necessary. Over the whole of this distance the embankment has been raised from 6 to 12′ and as in the rainy season the low-lying ground in the vicinity rapidly becomes flooded special precautions as to drainage are necessary. The embankments are being made from earth taken from the surrounding fields and from a trench dug alongside of the line, and among people who know the soil it is considered doubtful whether or not they will stand the rainy season. This earth possesses peculiar properties, and while in dry weather it is as hard as cement, in the rainy season it speedily becomes soft and spongey. At the stream at the foot of the hills between the paddy fields crossed after leaving Cheung Shui and Tai Po a bridge of considerable length will be necessary, and the line for some distance will be laid on a cutting out of the side of the hills. Everywhere between Sam Chun and Tai Po groups of men and women are hard at work breaking metal to ballast the line, and brick-making has become quite a flourishing industry in anticipation of the demand for bridge building. The line between Tai Po and Lok-lo-ha does not appear to have made much more progress so far, but the Sha-tin Valley, right up to the mouth of the tunnel. is alive with workers.

Imperial Chinese Railway Bonds.—On January 9th the Hongkong and Shanghai Banking Corporation invited subscriptions for £650,000 5 per cent Sterling Bonds of the Imperial Chinese Railways—Shanghai-Nanking-Line —being part of a loan for £3,250,000, of which £2,250,000 had been issued. The bonds are £100 each, and the first coupon for £1, being interest at the rate of 5 per cent *per annum* on the instalments, will be payable on June 1st next. The subscription price is par, and the loan is for 50 years from June, 1903, but the bonds are redeemable at six months' notice after 12½ years, and up to 25 years at 102½ per cent, and after 25 years at par at the option of the Chinese Government. In addition to the unconditional guarantee of the loan by the Chinese Government, both as to principal and interest, it is provided by the agreement that in the event of default in payment of principal or interest, the whole of the railway, with all its appurtenances, shall be handed over to the British and Chinese Corporation, to be dealt with by it in such manner as will ensure the proper protection of the interests of the bondholders. The loan agreement provides that in any negotiations between the railway administration and the British and Chinese Corporation, the corporation shall represent the bondholders and be empowered to act on their behalf. It also reserves the power to make a further temporary issue of £250,000 bonds at 6 per cent *per annum* for the purposes of paying for the necessary land for the railway, to rank *pari passu* with the present and former issues as regards guarantee and security, but to be redeemable at par at any time on giving six months' notice. The present loan is to provide further funds for construction and equipment and a report by the consulting engineers on the present position of the railway is included in the prospectus. According to the prospectus the subscription list which was opened January 9th was to be closed at or before 4 o'clock on the 11th. The bonds, however, were so largely over subscribed that the list for London was closed at 3 o'clock on the first day. It is stated that one application alone was for the sum offered. The bonds are quoted at 1 premium.

PUBLIC AND PORT WORKS, DOCKS, WHARVES, ETC.

River and Canal Conservancy, China.—The Ministry of Agriculture, Works and Commerce, at Peking has memorialized the Throne recommending the necessity for establishing a Conservancy for Rivers and Canals throughout the whole Empire, with headquarters at Peking, under a special High Commissioner, or Inspector-General.

Manila Sewer and Waterworks Construction Bonds.—Two millions of dollars worth of sewer and waterworks construction bonds for the City of Manila were sold recently in Washington by the Bureau of Insular Affairs. The total amount of the sale was $2,117,-005, gold, the relatively low price being due to existing conditions of the money market. The purchasers and the premiums were as follows:—$15,000 to William Larrabee, Clermont, Ia., at 1.091; $30,000 to R. W. Rohler, Detroit, Mich., at 1.09; $1,955,000 to William A. Read & Co., New York City, at 1.05777.

Tokyo Harbor Works.—The Tokyo Harbor Works Investigation Committee has submitted to the City Assembly its Harbor Works Bill. It is proposed to raise a foreign loan of £4,890,000 on the London market in connection with this scheme. The loan is to be raised in three installments, £2,000,000 in 1907, £2,000,-000 in 1911, and £890,000 in 1914. It is proposed to raise the loan at more than £96 per £100 face value and the rate of interest is to be 5 per cent. The documents pertaining to the present foreign scheme have been sent to the Governor of Tokyo for his consideration, and afterwards the Mayor of Tokyo will apply to the Ministers of Finance and Home Affairs for their approval.

Public Works, Pahang.—Provision is made in the Pahang, F. M. S., estimates for a long list of works and buildings, among them being $41,500 for a water supply for Bentong, a thriving mining center; $30,000 for a new *astina* for the Sultan of Pekan; and $10,000 for town drainage at Bentong. The other principal works include $5,000 for a house for the Executive Engineer at Kuantan, $3,500 for a surveyor at Bentong, and $9,000 for clerks' quarters at Lipis, Raub and Bentong. Police buildings, including stations at Pekan and at the new town of Gambang, in the Kuantan District, are estimated to cost $14,150. Municipal services account for $12,475, which sum includes $6,200 for the extension of the Kuantan water supply to the European Quarter at Teluk Sisek. Nine thousand dollars are provided for various hospital buildings, including an additional ward at Bentong. For new public offices and for extensions to existing one $10,200 are voted, of which $5,000 are for Pekan. Provision of $4,000 is made for a landing stage at Kuala Kuantan.

New Dredger for Penang, S. S.—For the improvement of the Port of Penang, Messrs. William Simons, Ltd., Renfrew, have launched a powerful bow-well, center-ladder, bucket, barge-loading dredger named the *Crab*. The dredger has been constructed under the direction of Messrs. Coode Son & Matthews, civil engineers of Westminster, assisted by Mr. Robert Anderson, Renfrew, local inspector. The *Crab* is classed at Lloyds. Propelling power is provided by one set of triple-expansion surface-condensing engines, supplied with steam from a steel boiler of Scotch type, constructed for a working pressure of 160 lbs. per square inch, according to *The London and China Express*. The auxiliary plants of the most modern type, including an independent circulating pump for circulating purposes, independent feed donkey pumps, evaporator, etc. and is fitted up in the engine room. The dredger's buckets have a total dredging capacity of 350 tons per hour and the maximum dredging capacity of 30′ below water level. Suitable clutches are provided for disengaging to and from the propelling engines and dredging gear, the arrangement of the latter allowing the dredger to make its own passage through banks and shoals. Comfortable quarters are provided for the officers and crew, and a complete electric light installation is fitted up on board, so that the dredger may be kept continuously at work, day and night, if required.

SHIPBUILDING AND GENERAL MARINE MATTERS

"Awa-Maru" in Drydock.—The N. Y. K. steamer *Awa-maru*, which stranded at Redcar, December 27th, is now in drydock at Newcastle-on-Tyne, where she will be overhauled and made seaworthy.

Japanese Shipping.—Official returns show that there were 1,492 steamships in Japan at the end of December, displacing 1,034,455.96 tons gross and 654,243.48 tons registered, whereof there were one vessel over 7,000 tons gross, twenty 6,000-7,000 tons, six 5,000-6,000, thirteen 4,000-5,000, forty-two 3,000-4,000, 108 2,000-3,000 and 131 1,000-2,000. Sailing-vessels numbered 4,044, displacing 346,262.02 tons gross and 324,668.38 tons registered, whereof one each was of over 3,000 tons gross and of 500-1,000. There was no ship between 1,000-2,000 tons.

Launch of the "Tjikini."—The steamer *Tjikini*, constructed for the Java, China and Japan Line, has been launched from the dockyard of the De Schelde Royal Company, at Flushing. The vessel has a length of 373′, a width of 45′ 5″, and a depth of 30′, destined for the cargo service, but has also accommodation for some first and second-class passengers, and for a large number of other classes. Special installations have been made for quick loading and discharging. The engines are of the vertical triple-compound system, with cylinders of 24¼,40, and 67″ diameter, and 48″ revolutions, developing 1,700 h. p., and 70 r. p. m.

YANGTSZE SHIPPING AMALGAMATION.—The proposed amalgamation of the Japanese steamer services on the Yangtsze River has now matured. These services are now being carried on by the Nippon Yusen, Osaka Shosen, Hunan, and the Daito steamship companies. The capital of the new company will be -Y-12,000,000. The steamers and other properties of the above four companies, which are used on the Yangtsze, are valued at -Y-8,000,000, and the remaining -Y-4,000,000 are being raised by the issue of new shares for public subscription. The promoters expect an annual subsidy of -Y-800,000 from the Government during five years.

NEW PACIFIC STEAMSHIP SERVICE.—The Grand Trunk Line of Canada has placed orders in America for several large cargo and passenger boats for service on the Pacific Ocean. The competition for the trade of the Pacific between the various steamship companies is now exciting much interest in shipping circles. For the North German Lloyd Company six new steamers are being built for its eastern trade, and when they are complete the company will extend its line from Yokohama to San Francisco, making the latter the final port on the voyage from Bremen. This will give the German company a passenger service around the world, with the exception of the land journey from the Pacific Coast to New York. It is stated that contracts for carrying passengers and freight have been made with the Gould railroads.

INOSHIMA DOCKYARD.—Inoshima, an island near Onomichi in the Inland Sea, was one of the few Japanese places to profit materially by the war. Its proximity to Hiroshima, which was the most important military station in Japan during the war, brought the Inoshima Dockyard Company considerable business, and its position in the center of the Inland Sea insures a continuance of work. The company possesses two dry-docks capable of docking vessels of 3,500 and 2,500 tons respectively. The number of vessels docked during 1905 was 68. The increasing size of ships makes it necessary for the company to enlarge its facilities and it proposes to increase its capital from -Y-200,000 to -Y-1,000,000. The docks are to be enlarged so as to take vessels up to 8,000 tons and a shipbuilding and engine works plant will be added.

COAL TRANSPORTATION TO PHILIPPINES.—Bids have been opened at the Bureau of Equipment, Navy Department, Washington, for the transportation of 50,000 tons of coal to the United States coal depot, Sangley Point, Manila Bay, or for furnishing and transporting that amount. Proposals were received as follows, the amounts being in gold:—(a) For transportation only in American vessels; (b) for transportation only in foreign vessels; (c) for American coal delivered at Sangley Point. The following bids were received: Frank Waterhouse & Co., Seattle, Wash., (b) $5.35 per ton; $267,500. J. J. Moore Co., San Francisco, Cal., (d) $8.85; $442,500. Chas. Dunlap, New York, (e) $8.88; $444,000. Howard, Holder Rowat Co., New York, (b) $4.98; $249,000. Arthur Sewall & Co., (a) $6.50 per ton for 5,000 tons. Castner, Curran & Bullitt, London, (d) $8.75; $437,500. Samuel Holmes, 66-8 Broad St., New York, (b) $5.60; $280,000. Funk Edye & Co., New York, (b) $4.93; $246,500. Lind & Co., New York, (b) $4.70; (c) $7.50 and $7.25. Mc. Call, Dinning & Co., Baltimore, (d) $8.71; (b) $5.08½.

MINING, MINERALS AND THE METAL TRADES

IRON ORE IN SHANTUNG.—Magnetic iron ore, containing 65 per cent of iron, has been discovered in the Province of Shantung.

MANCHURIAN GOLD MINES.—A dispatch from Harbin says that Russia has returned to China the gold mines in the Amur Province.

FORMOSAN IRON WORKS.—Japanese capitalists are organizing the Formosan Iron Works with a capital of -Y-1,000,000. The head office and workshops will be in Formosa.

BURMA'S OIL PIPE LINES.—The Burma Oil Company has placed contracts with American and Glasgow firms for 275 miles of pipe lines to convey oil from wells in Burma to the seaboard.

YOKOHAMA ENGINE AND IRON WORKS.—This concern has declared a dividend of -Y-15 per share for the workings of the latter half-year of 1906. The report shows a balance of -Y-2,500 after all accounts had been paid.

GOLD MINES IN KOREA.—Out of 40 applications for the possession of mines in Korea, three have been granted the privilege of commencing operations. This refers to applications made by private individuals, probably Koreans.

MINES OF SHANTUNG PROVINCE.—During 1904 the mines of the Shantung (China) Mining Company had an output of 90,000 tons of coal, and in 1905 of 134,000 tons, and coal is now laid down in Chefoo at prices considerably under Japanese and Kaiping supplies.

RAUB GOLD MINES, F. M. S.—On a hill about 1,000′ north of No. 2 Shaft the jungle has been cleared and several pits sunk; also a crosscut put in 50′. An enormous quantity of surface ore is being exposed, and further pits are being sunk. A crosscut has also been started from the east side of the hill, A Singapore paper says this is the best news the shareholders have received for some time.

COAL AND IRON DEVELOPMENT, CHINA.—American Consul Thornwell Hayes affirms the report that there has recently been found in the vicinity of Nanking, on the banks of the Yangtsze, undisputed evidence of immense iron and steel deposits. "In a recent conversation with a Chinese official," says the Consul, "I was told that capital was needed to develop these mines, but that to avoid arousing Chinese prejudice such capital should be invested as emanated from Chinese. This official is greatly enthused over these dormant potentialities."

SALIMBAU COAL COMPANY.—With reference to this company, in which many Singapore capitalists are interested, the Netherland Indies Share List says that the mining engineer who was sent to investigate the property reports a series of strata containing coal of good quality easily worked, and capital will be asked for in accordance with the estimates of expenditure. Development will then be begun on a small scale and a portion of the concession will be thoroughly prospected. The experience gained in this way will show what it will cost to win the coal and the probable profit to be made.

FUSHUN COAL MINES.—An engineer, who visited the Fushun coal mines recently and carried out full investigations, denies the reports that the coal from the mines is not very good in quality. On the contrary, he says, the coal is excellent, containing much carbonic and volatile elements. It has not much sulphur and in this respect is superior to the Japanese coal at Kyushu and Hokkaido. The area of the mines extends to 4,000,000 *tsubo*, the depth of the strata being 110′. The total quality of coal is estimated at about 500,000,000 tons.

GOLD ON THE EAST RIVER, CHINA.—Canton advices are to the effect that Chinese restlessness is seen in many reports which are made from time to time as to the necessity of opening mines, and in the requests made by individual Chinese for permission from the authorities to do something of the kind. It has been reported in native papers that a move has been made by one Chinese to test the accuracy of his prospecting up the East River, by which he is convinced that, in the Mountain of the Goddess of Mercy, at Tsang Shing, there is gold. The gentleman in question has sent in a petition to the Viceroy, who has granted the necessary permission for searching.

MALAY STATES TIN EXPORTS, 1906.—The advance statement of block tin and tin ore exported from the Federated Malay States during 1906, and of the duty collected thereon, shows that the total quantity of tin was 782,296.89 piculs (1 picul = 133 ⅓ lbs.) as compared with 821,780.86 piculs in 1905, a decrease of 39,483.97 piculs. Of this decrease Selangor shows a decrease of 21,000, Perak of 10,000 and Negri Sembilan of 7,000 piculs. The duty paid was $9,758,881.42 local currency, an increase of $769,125.95 over the amount paid in 1905. Perak paid $577,000, Selangor $161,000, and Negri Sembilan $29,000 increased duty. The figures for Pahang are not yet available.

GOLD MINING CONCESSION, KOREA.—The *Cologne Gazette* announces that a gold-mining concession north of Pingyan (Phyong-yang) has been granted to a German firm at Chemulpo. Pingyang is 36 miles from the sea on the Taidong. It is well populated, being the center of a silk industry, and 20 miles off, at Keum-san, are rich gold-washings. This metal, especially in the shape of river gold, abounds almost everywhere in the northern half of the peninsula. The output reaches $5,000,000 (Mexican) worth a year. Gold-mining is carried on by an American company, which is working the Wonsan deposits, by British subjects near there, and by German, Japanese, and Russian concessionaries. Copper, iron and coal are also found in abundance.

SIBERIAN GOLD MINES.—Not long ago, says a Russian paper, certain interested parties, more particularly a number of Australian gold-mining men, disseminated misleading reports to the effect that the Russian Government was badly disposed towards the establishment of foreign enterprises in Russia. These rumors brought about a depreciation in the shares of Siberian companies. However, the danger speedily disappeared, chiefly owing to the establishment. without any alteration of the rules, of the Orsky company. The leading financial organs, with a feeling of satisfaction, note these facts, which are accompanied by a general improvement in the financial situation. The result has been a strengthening of the demand for shares of companies which are operating in Siberia.

IMPERIAL STEEL WORKS, JAPAN.—The Japanese Government is placing contracts in the United States for the equipment of a very large steel works, to be erected on the Island of Moji. This plant, which will entail an outlay exceeding $10,000,000 gold, will consist in the first instance of two bar mills, tube mill, blooming mill, rolling tables, furnaces, cranes, and a complete outfit of steel-making plant. The name of the proposed concern is the Imperial Steel Works. The contracts are being made through the New York offices of three Japanese firms: Messrs. Mitsui & Co., Takata & Co., and Okura & Co. A general line of machinery for a large lead mill and complete plant for a tin-plate mill to be erected under Japanese auspices in the vicinity of Kobé is also under order in America.

ASHIO COPPER MINES, JAPAN.—According to one authority the recent riots at the Ashio copper mines near Nikko were possibly the culmination of a dispute which has been going on for many years. The mines are the richest in Japan, the output of copper in 1904 being 10,965,862 *kin* (1 kin 1.322 lbs.). When copper was first discovered the villagers did not recognize that the workings of the mines meant the destruction of the country around as far as agriculture was concerned. They speedily found, however, that their crops were being ruined and that the flow of waste products into the rivers was killing all the fish. The late Ichibei Furukawa, recognizing the hardship under which the people were suffering, offered to buy the lands of all those who were affected at a price to be fixed by arbitration. Some of the villagers were agreeable but the majority refused to part with the lands which their forefathers had tilled and they intimidated the minority so that Mr. Furukawa's well-meant offer was declined. Since then there has been constant friction.

FINANCIAL AND MISCELLANEOUS

HONGKONG FIRE INSURANCE COMPANY, LTD.—The 1906 account of the company shows a credit balance of $435,236.75 (Mexican).

SUGARMILL MACHINERY.—The Dutch East-Indian Government is contemplating the construction of sugar-cane mills in Madoera.

ONE-HUNDREDTH BANK, JAPAN.—The One Hundredth Bank of Japan has received the approval of the shareholders to increase its present capital of -Y-600,000 to -Y-2,000,000.

RICE MILL FOR THE MORO PROVINCE, P. I.—The Bank of Zamboanga is the prime mover in the establishment of a rice mill at Zamboanga to be equipped with the latest machinery from America.

PRICE OF GAS REDUCED, HONGKONG.—Beginning with the first day of the current month, the Hongkong and China Gas Company, Ltd., will hereafter furnish gas to consumers at $2.75 Mexican currency per 1,000 cubic feet.

COLD STORAGE FOR ZAMBOANGA, P. I.—Mr. F. E. Holmes, an Australian, is establishing a cold storage plant at Zamboanga, capital of the Moro Province, for the purpose of supplying to the trade Australian frozen meats, game and dairy products.

SOMERSET RUBBER ESTATE.—This concern has been registered with a capital of £12,000 in £1 shares. to acquire from H. W. Bratt an estate in Perak, F. M. S., to cultivate rubber, etc. No initial public isuse. The head office is 11 Idol Lane, London, E. C.

STRATHMORE RUBBER COMPANY.—This concern has been registered with a capital of £25,000 in £1 shares, to acquire and develop as a rubber estate a block of land near Batarg Berjuntai, Selangor, F. M. S. Registered office, 8 Hill-st., Edinburgh. No initial public issue.

STEEL DERRICK, OLONGAPO, P. I.—The Bureau of Yards and Docks, Navy Department, Washington, has awarded to the Pittsburg Industrial Iron Works a contract for furnishing one 20-ton steel derrick at the coaling station, Olongapo, P. I., the company's bid being $3,016.

JAPANESE CONTRACTING CONCERN.—Japanese capitalists have a scheme to organize a company with -Y-2,500,000 capital at Tientsin, China, with the object of carrying on the business of building houses and warehouses, supplying electric light and power, and also acting as commission agents in money lending.

SENGON (JAVA) COMPANY, LTD.—This concern has been formed with a capital of £22,000, divided into 22,000 shares of £1 each, of which 15,000 shares are being offered privately. The company acquires the Sengon Estate in Java and the business of rubber, coffee, pepper, cinnamon, vanilla, nutmeg, and cocoa planters.

TOKYO'S BUDGET.—The Budget for Tokyo in the forthcoming fiscal year is calculated as follows:—*Income*—Ordinary, -Y-4,294,673; extraordinary, -Y-78,295, *Expenditure*—Ordinary, -Y-3,829,622; extraordinary. -Y-538,490. The income is about -Y-296,000 less than the previous year, and the expenditures are -Y-277,000 less.

ARCHITECTURAL COMPETITION.—A competition for plants for a Protestant church in Tsingtau, the German Settlement in North China, is now open to architects resident in the Far East. Three prizes of the value of $1,500, $1,000 and $500 (Mexican) are offered. Further particulars may be obtained on application, accompanied by the payment of $4 (Mexican), to Herr Bandirektor Strasser, Tsingtau.

JAPANESE MACHINERY COMPANY.—A number of influential capitalists of Tokyo and Osaka are contemplating a company with -Y-2,000,000 capital, under the style of the Manshu Kigyo Kaisha, with the object of conducting the business of selling machinery for civil engineering, railways, mines, etc., the head office to be at Tokyo with branches at Osaka, Tairen, Port Arthur, Liaoyang and Mukden.

POWER GAS INSTALLATION, JAPAN.—A contract has been placed with the Power Gas Corporation, Stockton-on-Tees, for a large power gas installation at Fuji, near Yokohama. The plant will have a rated capacity of 3,000 i. h. p., and is designed to produce about 180,000 cu. ft. of gas per hour from local fuels. The whole of the gas produced is to be specially cleansed so as to be suitable for use in gas engines.

SHOE TRADE, SHANGHAI.—The German Consul-General at Shanghai reports that during 1906 there were imported at Shanghai 129,405 pairs of rubber shoes and 46,643 pairs of cloth and leather shoes, against 22,916 and 21,468 pairs, respectively, entered in 1904. The Consul-General adds that this shows that the wealthier part of the Chinese population is gradually stepping in the foot-tracks of western civilization.

RECONSTRUCTION OF THE INDO-CHINA STEAM NAVIGATION COMPANY, LTD.—Messrs. Jardine, Matheson & Co., of Shanghai, announce that the scheme to divide the £10 shares of the Indo-China Steam Navigation Company into two of £5 each—one preferred and one deferred—has been agreed to by the shareholders at a meeting held in London, The interest on the preferred shares will be at the rate of 6 per cent *per annum* instead of 5½ per cent as first proposed.

Foreign Bank Notes, Shanghai.—According to *The Celestial Empire*, Viceroy Tuan Fang has advised the Board of Finance at Peking that there are many kinds of foreign bank notes in circulation in Shanghai—over Tls. 3,000,000 worth of them—and unless a check is made at this moment it will cause bad effects upon Chinese currency. Wang Shao-yen, Director of the Bureau of Commerce at Nanking, has been sent to Shanghai to study the matter, who reports that it is necessary to issue bank notes of the Hupu Bank to be circulated in the open ports and towns to replace the foreign bank notes.

CROSSING SIBERIA BY RAIL

(Concluded from page 335)

Table of Times and Fares.—Hotels.—For convenience pounds sterling are reckoned at \$5 and rubles at 50 cents in the following schedule:—

	Time of departure.	Fares.
London to Berlin (via Dover-Ostend)	9 a. m.	\$69.01
Berlin to Petersburg	10 a. m.	
St. Petersburg to Moscow	10.30 p. m.	121.40
Moscow to Irkutsk	12 10 a. m.	
Irkutsk to Harbin	8 56 p. m.	
Harbin to Changchun	10.30 p. m.	5 06

a Government express trains leave Sundays and Thursdays; carriage-lighted on Wednesdays.

For food on the train \$2.50 to \$3 a day should be allowed, while hotel charges are as follows: St. Petersburg—Hotel de Europe, \$1.75 to \$10 per day; Hotel de France, \$1.75 to \$7.50 per day. Moscow—Hotel National, \$1.50 to \$5 per day; Hotel Metropole, \$1.50 to \$7.50 per day. Harbin—Gomaretle Hotel, \$1.50 to \$5 per day.

RAILWAY CONSTRUCTION, JAPAN

The railways in Japan, the construction of which has been decided upon, are as follows:—

Line.	*Section.*	*Mileage.*
Ou	Fukushima and Aomori	300
Central	Hachioji and Nagoya	224
Kagoshima	Yatsushiro and Kagoshima	94
Sanin	Fukuchiyama, Sakae and Imaichi	193
Maizuru	Fukuchiyama, Tobe and Shin-Maizuru	50
Toyama	Toyama and Naoezu	75
Hokkaido	Asahigawa and Chinai	168
Hokkaido	Asahigawa and Kushiro	191
Hokkaido	Kushiro and Nemuro	89
Hokkaido	Ikeda and Amibashiri	117
Hokkaido	Fukagawa and Rumoe	35

The lines which the Government intends to construct in future are as follows:—

Section.	*Mileage.*
Akita and Shinbota	150
Sakamachi Yonezawa	52
Yokote and Kurozawajiri	35
Sakata and Funagata	32
Funagata, Koteda and Ishinomaki	68
Sintsu and Shinbota	15
Katsuura, Ohara and Seito	13
Kofu and Iwafuchi	47
Tsuruga and Shin-Maizuru	51
Imaichi and Kogori	139
Hiroshima and Ezu	105
Tsuyama and Yonako	63
Tadotsu, Imaharu and Matsuyama	92
Takamatsu Kochi Susaki	124
Kawada and Kajima	6
Oita Miyazaki and Yoshimatsu	167
Kumamoto and Oita	83
Gifu and Takimi, (Oiwake and Funakawa)	26

The total expenditure of the intended lines is estimated at -Y-246,622,600.

CIRCULAR PROPOSAL

Bureau of Navigation

Lighthouse Division

Manila, P. I., February 18, 1907.

Sealed proposals, in duplicate, for the furnishing and delivery alongside the Lighthouse Wharf on Engineer Island, Manila, P. I., of a Third-Order flashing light for Batag Island, will be received at this office until 11 o' clock a m , June 2 , 1907, and then publicly opened. Specifications, blank forms and all available information will be furnished upon application to this office.

The Government reserves the right to reject or accept any or all bids, or any part thereof, or to waive any informality in bids

Proposals must be signed by the bidder, enclosed in sealed envelopes, addressed to the undersigned and marked "Proposals for Batag light: to be opened June 20, 1907."

Wildurr Willing,

1st Lieut Corps of Engrs., U. S. A.,

Lighthouse Engineer.

NOTICE

February 28, 1907.

(1) The Bureau of Navigation, Philippine Government, offers for sale at Engineer Island, Manila, P. I., the following property:

(a) The steam launch SIASI, a seagoing launch 86 feet in length over all, beam 14 feet 5 inches, depth moulded 7 feet six inches, draft loaded 7 feet, draft light 6 feet, built at Hongkong in 1900. She is fitted with compound surface condensing engine and is in first-class condition, with feed-pumps and all necessary fittings attached. Has boiler of Scotch type, diameter 6 feet 6 inches in first class condition, with all necessary fittings. The hull is sound and strongly constructed and shows no sign whatever of deterioration. This launch throughout is in excellent condition and is ready to be put into commission at once.

(b) The steam launch JOLO, a seagoing launch 65 feet in length over all, beam 11 feet 4 inches, depth moulded 5 feet, 8 inches, draft 5 feet, built in 1890. Has compound surface-condensing engine in good order and a boiler of the Scotch type in fair condition. All fittings in engine room are in good condition. This launch is ready to be put into commission at once.

(c) The steam launch SUERTE, a river and harbor launch 61 feet 7 inches in length over all, beam 11 feet, draft 5 feet, tonnage 21.81 gross. Has compound non-condensing engine and Scotch boiler. Engine and boiler are in fair condition. This launch is ready to be put into commission at once.

(2) Sealed bids will be received up to and including March 16, 1907, and will then be publicly opened at 4:00 p. m. on that date. The right is reserved to reject any or all bids. Proposals must be accompanied by cash or a certified check for the amount of ten per cent of the bid. Full payment will be required within five days after the acceptance of the offer of the successful bidder, or upon delivery of the vessel which must be within five days.

(3) These vessels may be inspected at Engineer Island, Manila, P. I.

(4) Further information will be given if application is made therefor to the undersigned.

Frank P. Helm,

Director of Navigation.

HAY AND OATS

Office of the Bureau of Supply

Manila, P. I., March 5, 1907.

Sealed proposals in triplicate will be received at this office up to 11 a. m. March 25, 1907, when they will be opened in the presence of the attending bidders, for furnishing 900 Tons of Hay and 600 Tons of Oats.

Proper forms and specifications may be had on application to this office.

E. G. Shields,

Purchasing Agent.

Specifications on file at the Office of THE FAR EASTERN REVIEW.

OFFICE OF THE BUREAU OF SUPPLY

Manila, P. I., March 12th, 1907.

Sealed proposals in triplicate will be received at this office up to 11 a. m. May 15th, 1907, when they will be opened in the presence of the attending bidders, for supplying the Insular Government with *Thirty Thousand (30,000) tons of Coal* for the period from July 1st, 1907, to June 30th, 1908.

Proper forms and specifications may be had on application to this office.

E. G. Shields,

Purchasing Agent.

PROPOSALS FOR MINERAL OIL

Headquarters Philippines Division.

Office of Chief Quartermaster.

Manila, P. I., March 15th, 1907.

Sealed proposals, in triplicate, subject to the usual conditions, for furnishing 315,000 gallons of Mineral Oil to this Department, will be received at this office until 10:00 a. m. April 15th 1907 and then opened. Blank forms and information furnished upon application. Envelopes containing proposals should be endorsed, "proposals for Mineral Oil" to be opened at 10:00 a. m. April 15th 1907 and addressed to Chief Quartermaster, Philippines Division, Manila, P. I.

NOTICE TO CONTRACTORS

Sealed proposals will be received at the office of the Director of Public Works until noon April 10, 1907, and then publicly opened, for furnishing all the materials, labor and plant, and constructing complete the San Miguel de Mayumo-Sibul Springs road and structures thereon in Bulacan Province for the Bureau of Public Works.

Envelopes containing proposals should be plainly marked, "proposal for San Miguel de Mayumo-Sibul Springs road. Each proposal must be accompnaied by bond or certified check to the amount of ₱2,000 The right is reserved to reject any and all bids and to waive defects.

Plans, specifications, and contract can be seen and examined at the office of the Director of Public Works. Additional information will be furnished upon application.

Bidders are requested to be present at noon, April 10, 1907, when bids for the work will be opened.

Address all communication to "THE DIRECTOR OF PUBLIC WORKS, Potenciana Building, Manila, P. I."

J. W. Beardsley,

Director of Public Works.

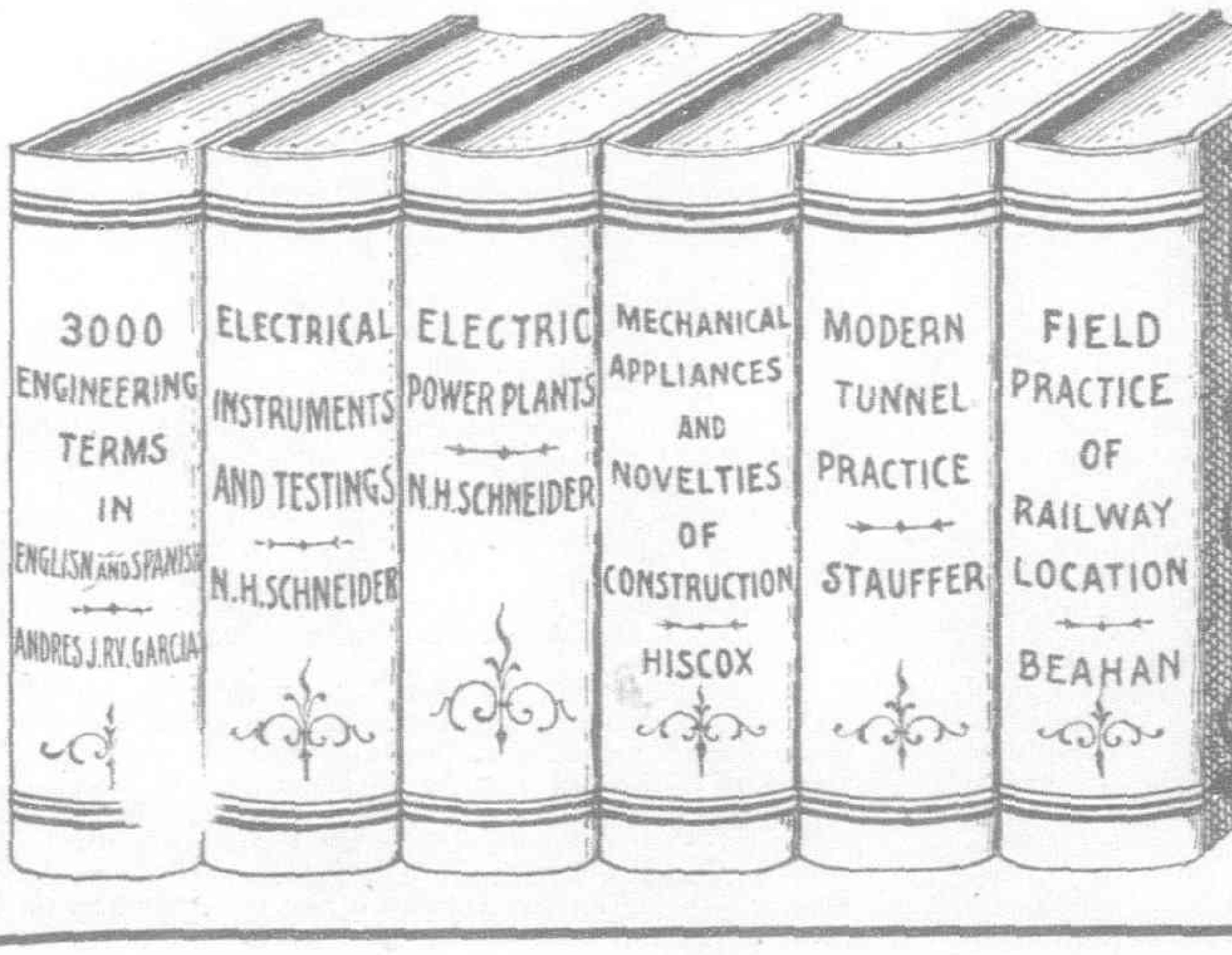
To Contractors. Office of the Bureau of Public Works, Santa Potenciana Building, Manila, P. I., March 20, 1907.

Sealed proposals addressed to the undersigned and plainly marked "Proposal for C. A Set 126," will be received at this Office until 11:00 A. M., April 10, 1907, for furnishing all material and doing all labor required to fully complete the erection of a Provincial High School at Iba, Province of Zambales, P. I., in the manner and on the conditions set forth in the form of proposal and the plans and specifications, copies of which with other information may be obtained upon application at the office of the Director of Public Works, or to the Provincial Treasurer, Iba, Zambales, P. I.

The right is reserved to reject any or all bids or to waive any defects.

J. W. Beardsley,

Director of Public Works.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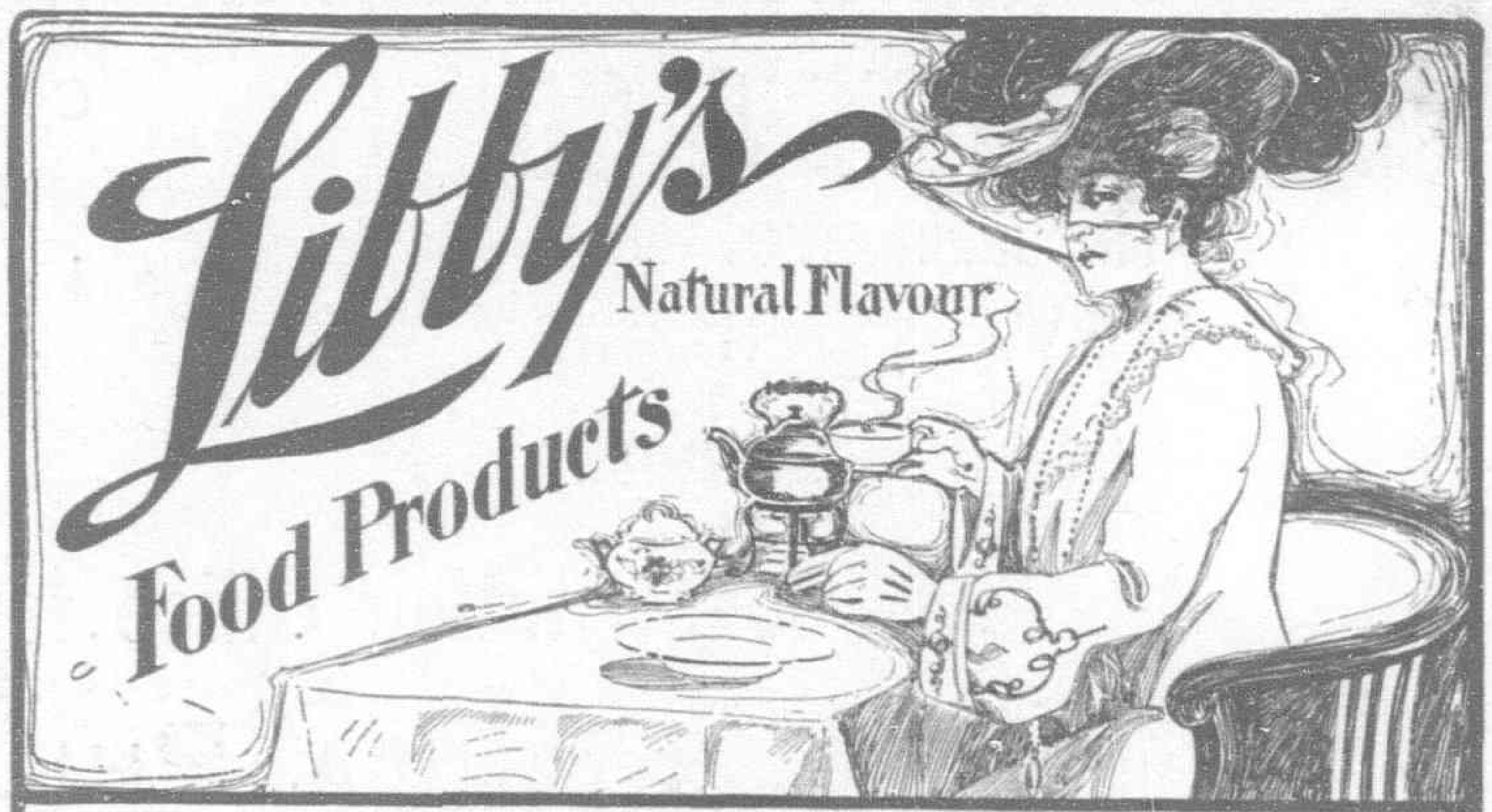

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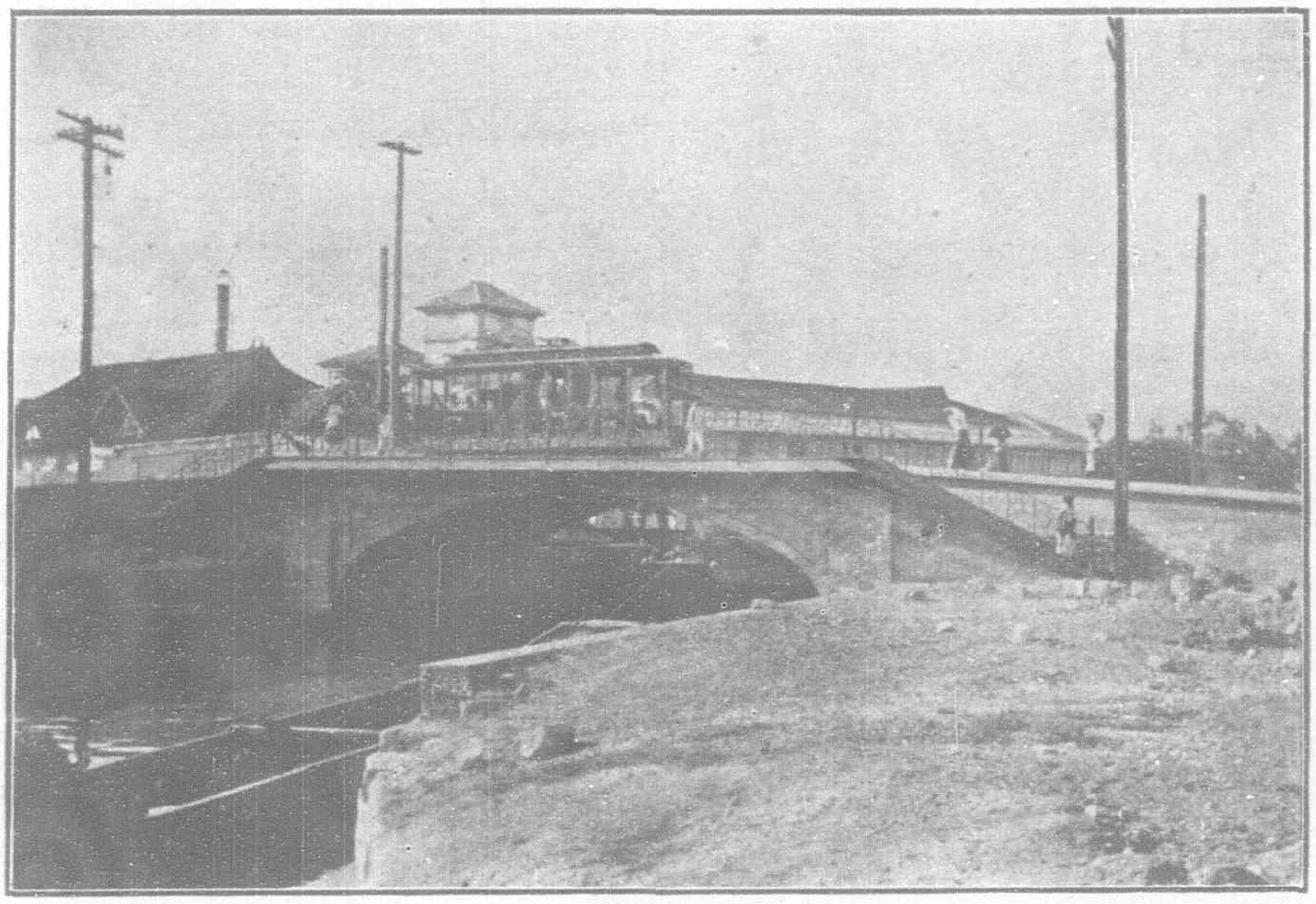

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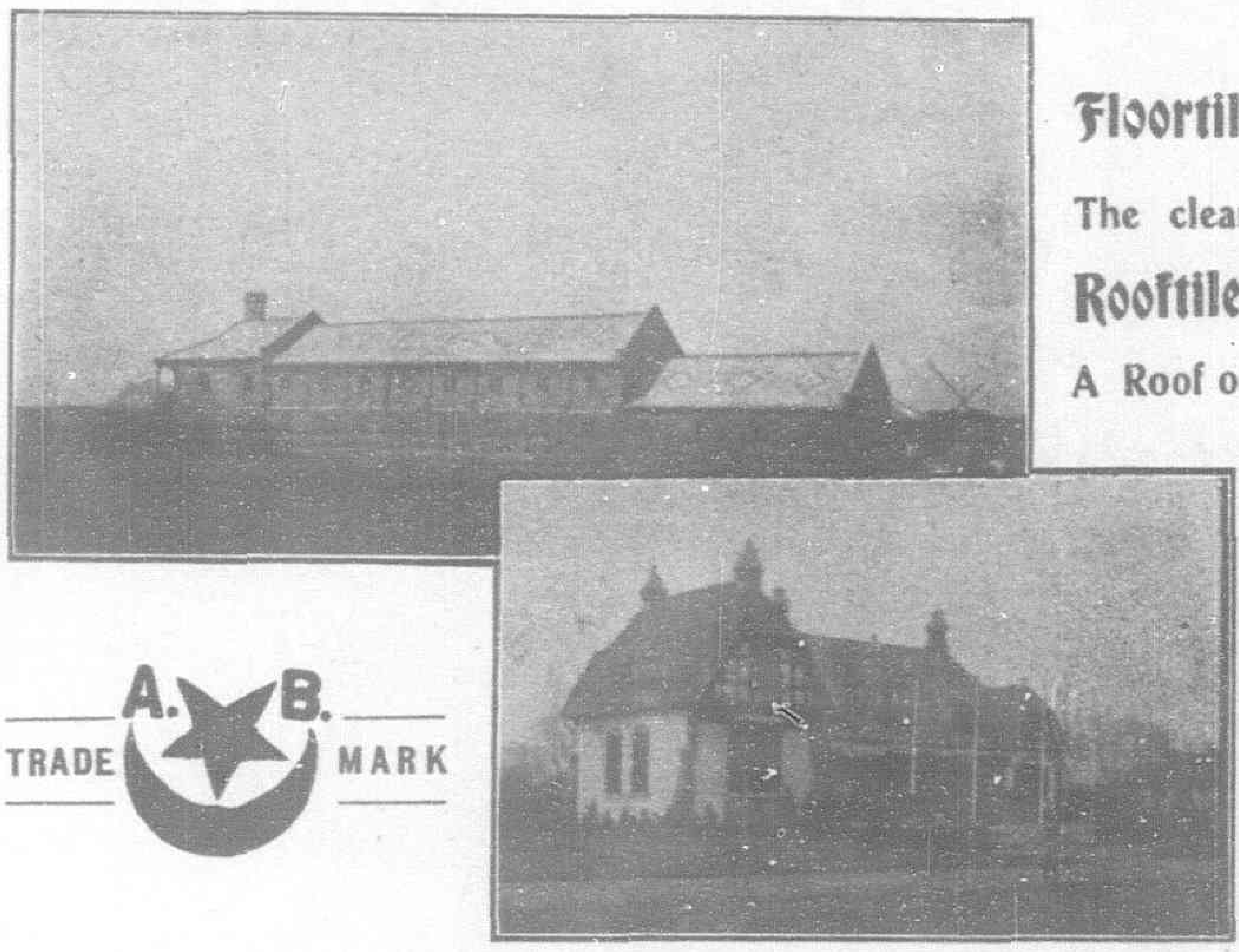

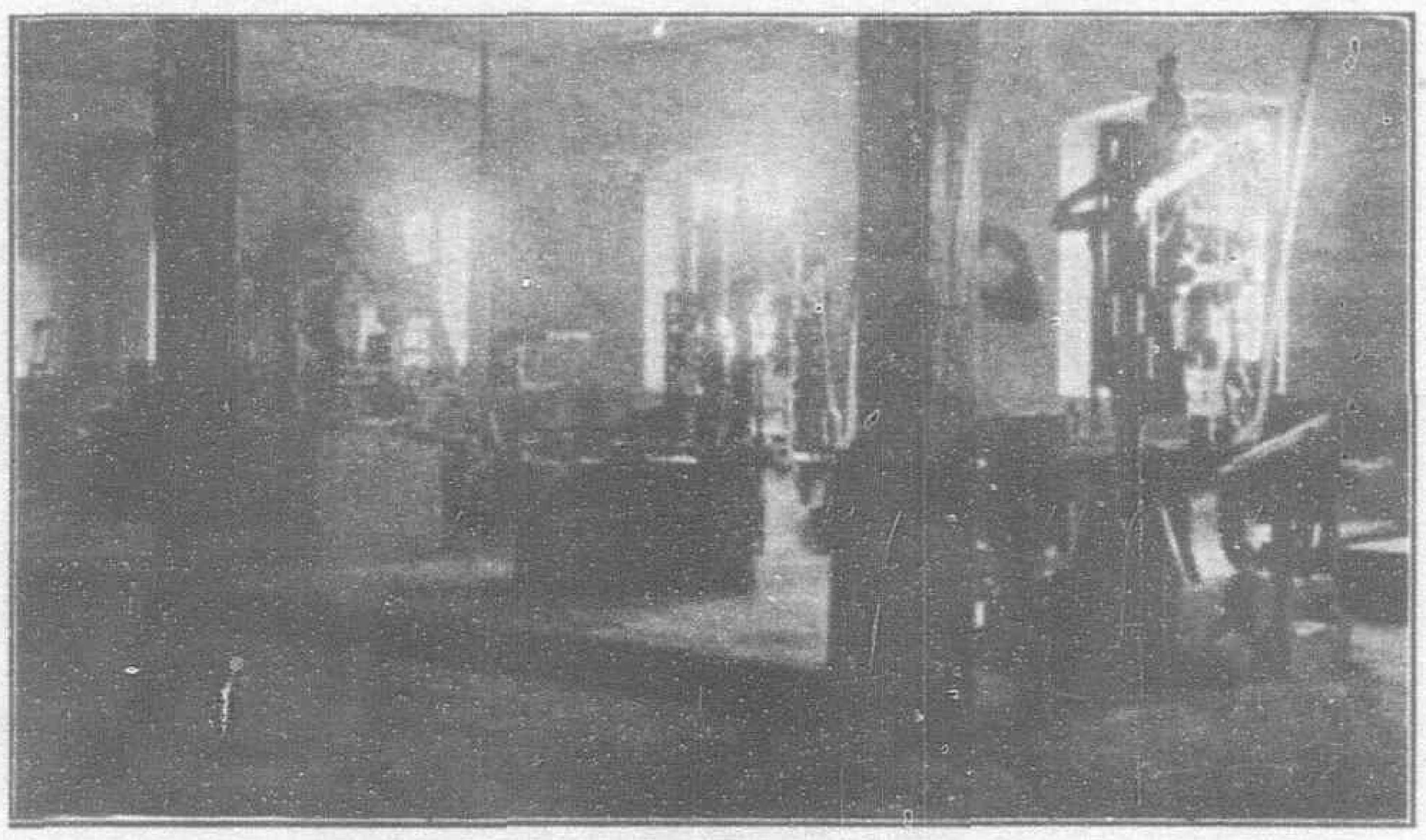

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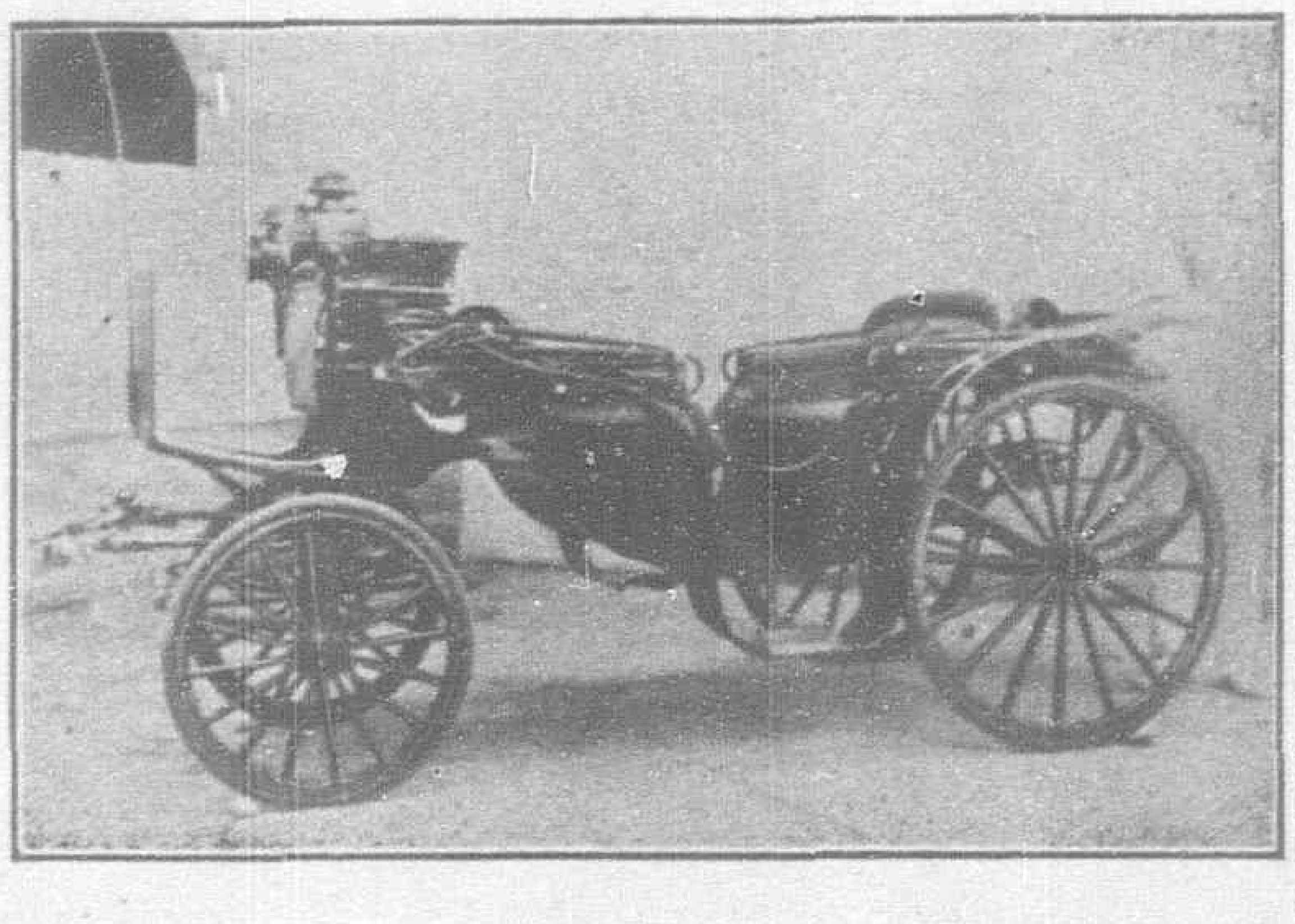

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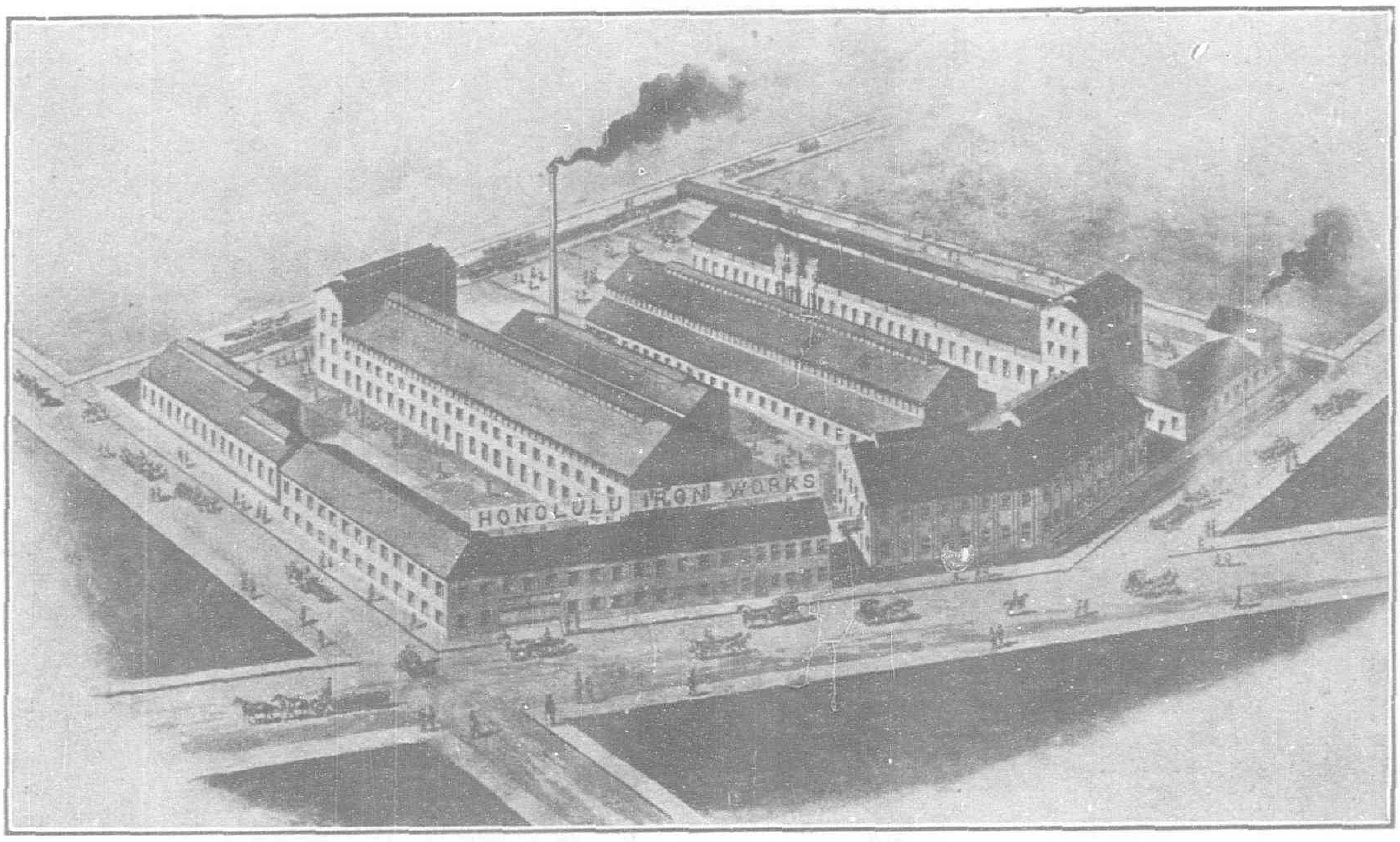

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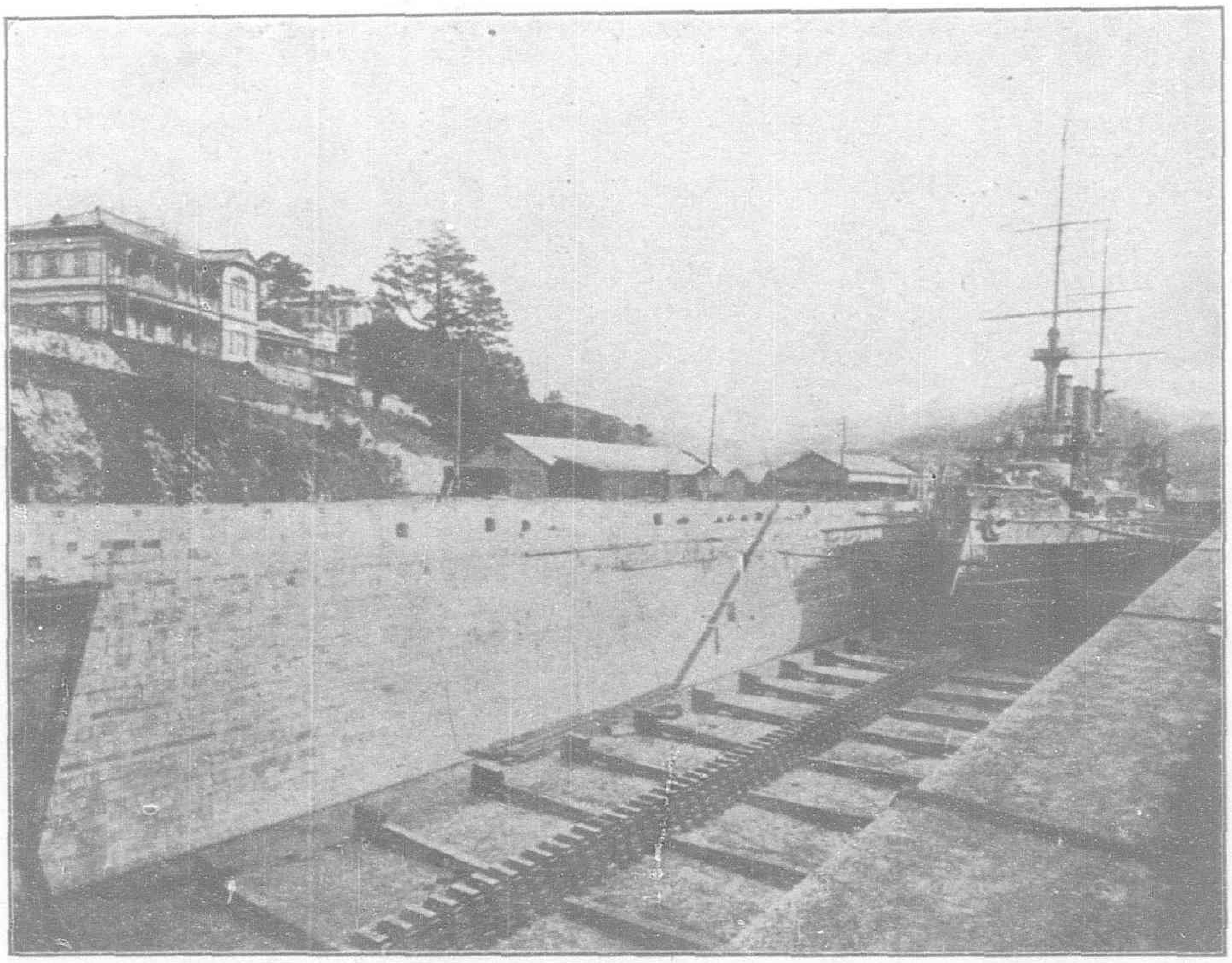

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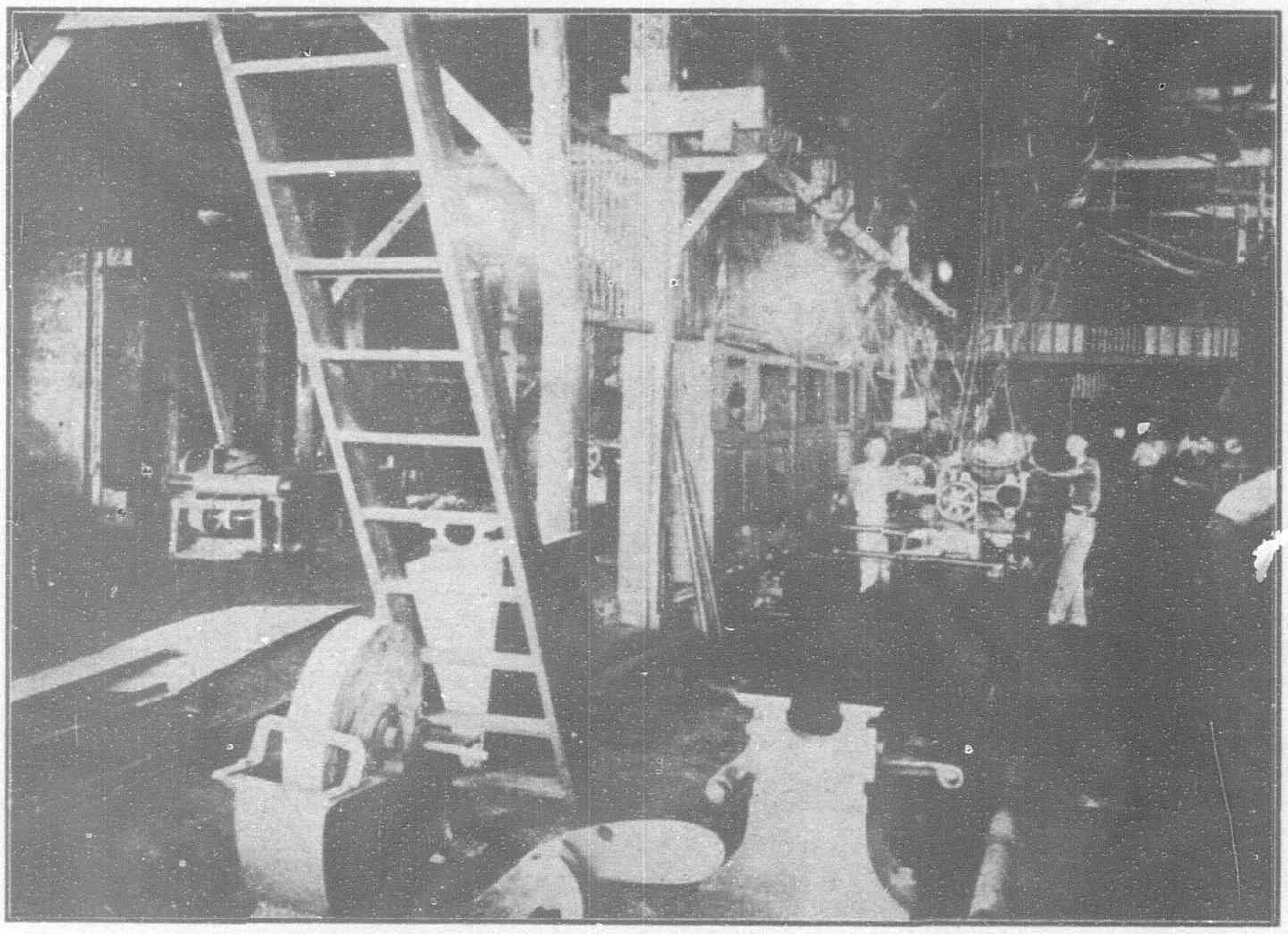

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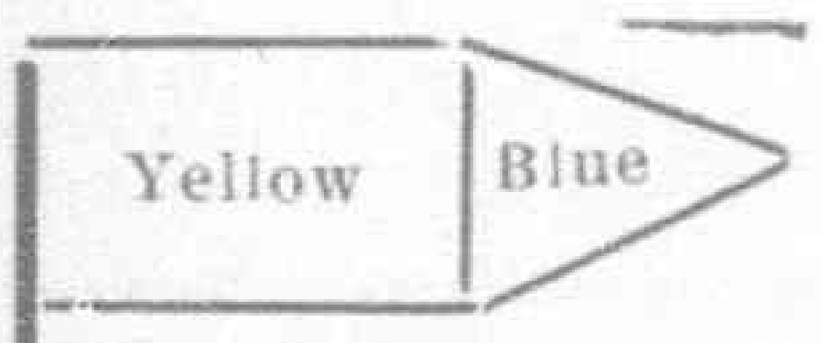

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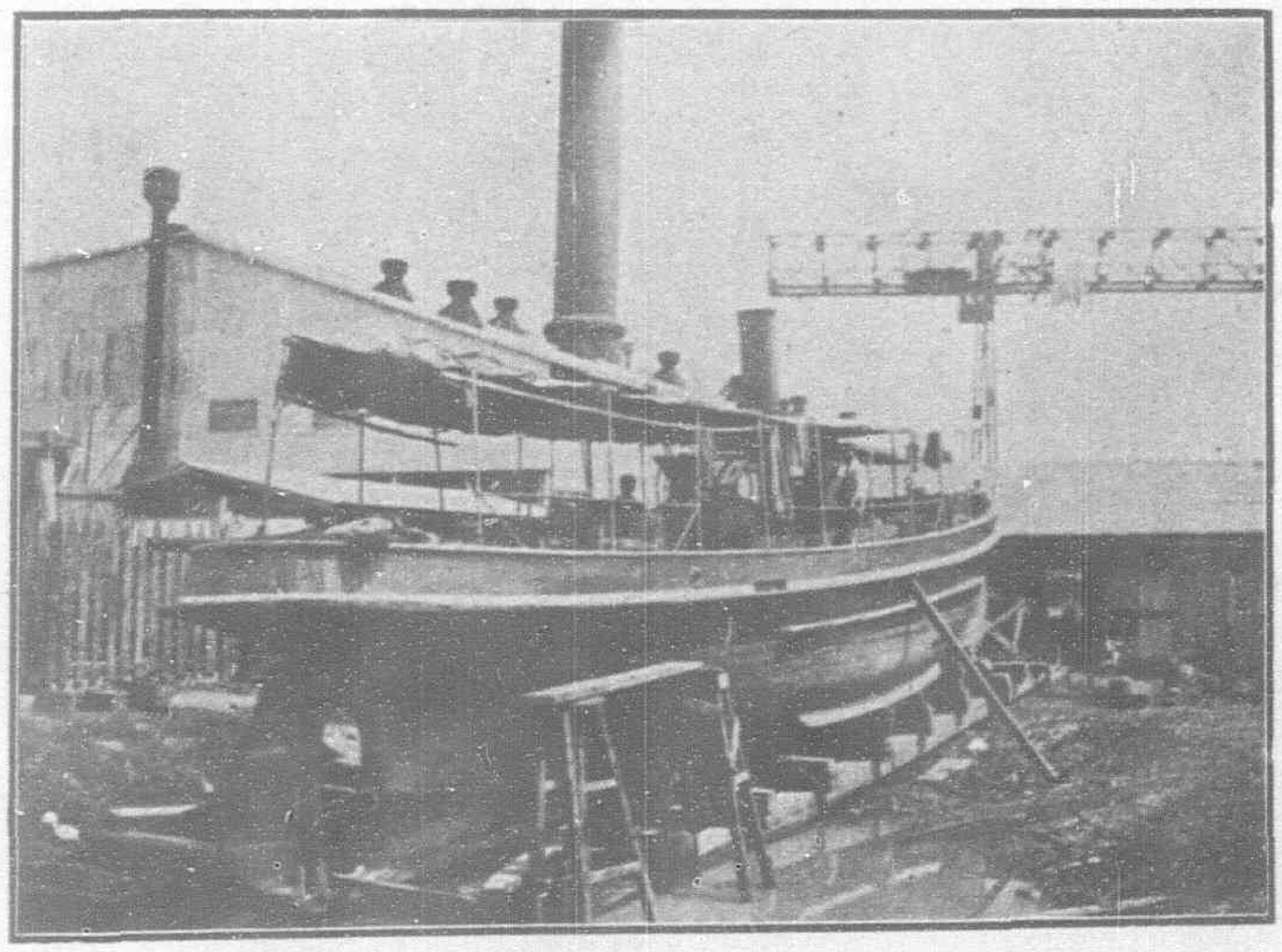

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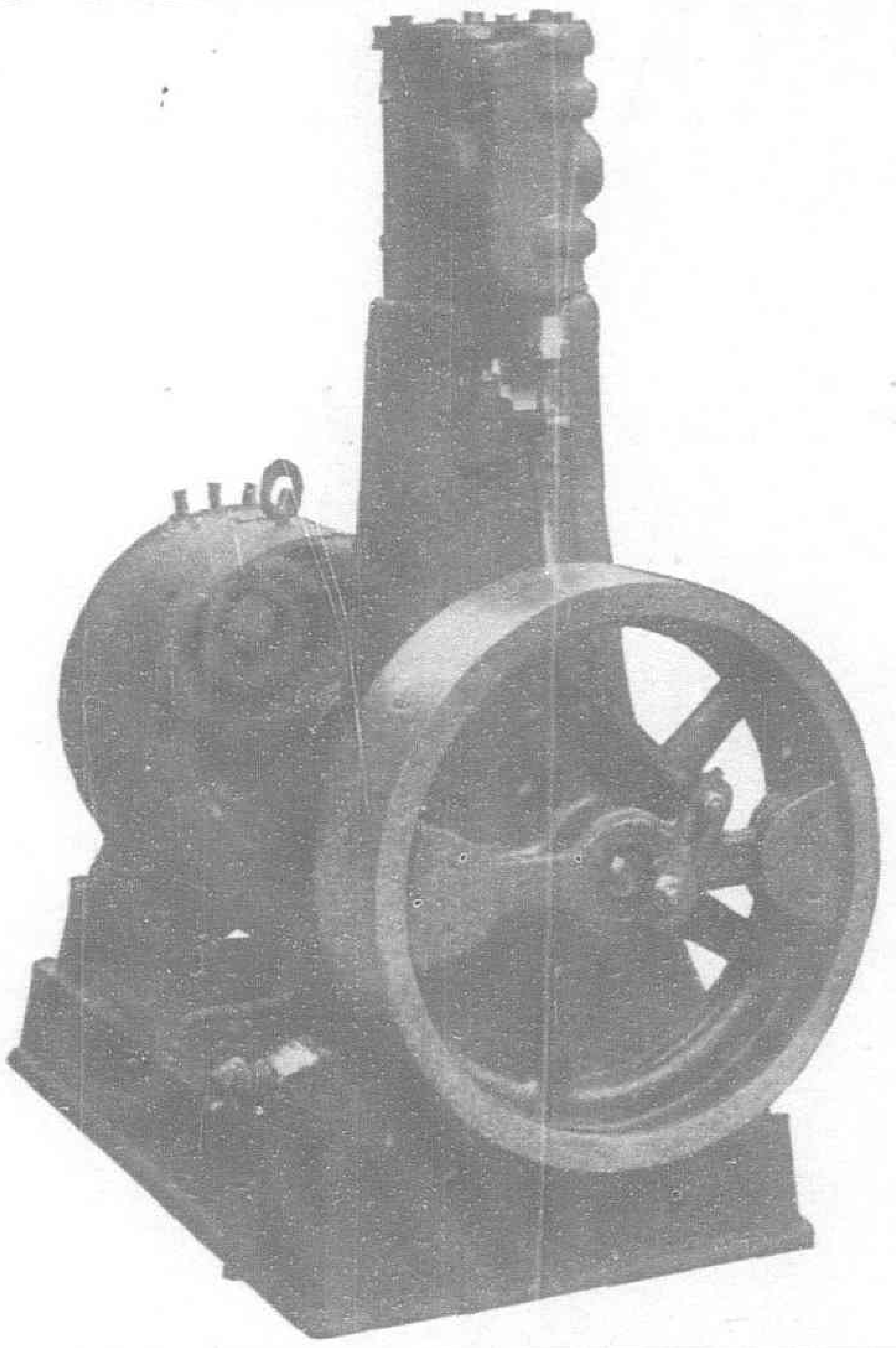

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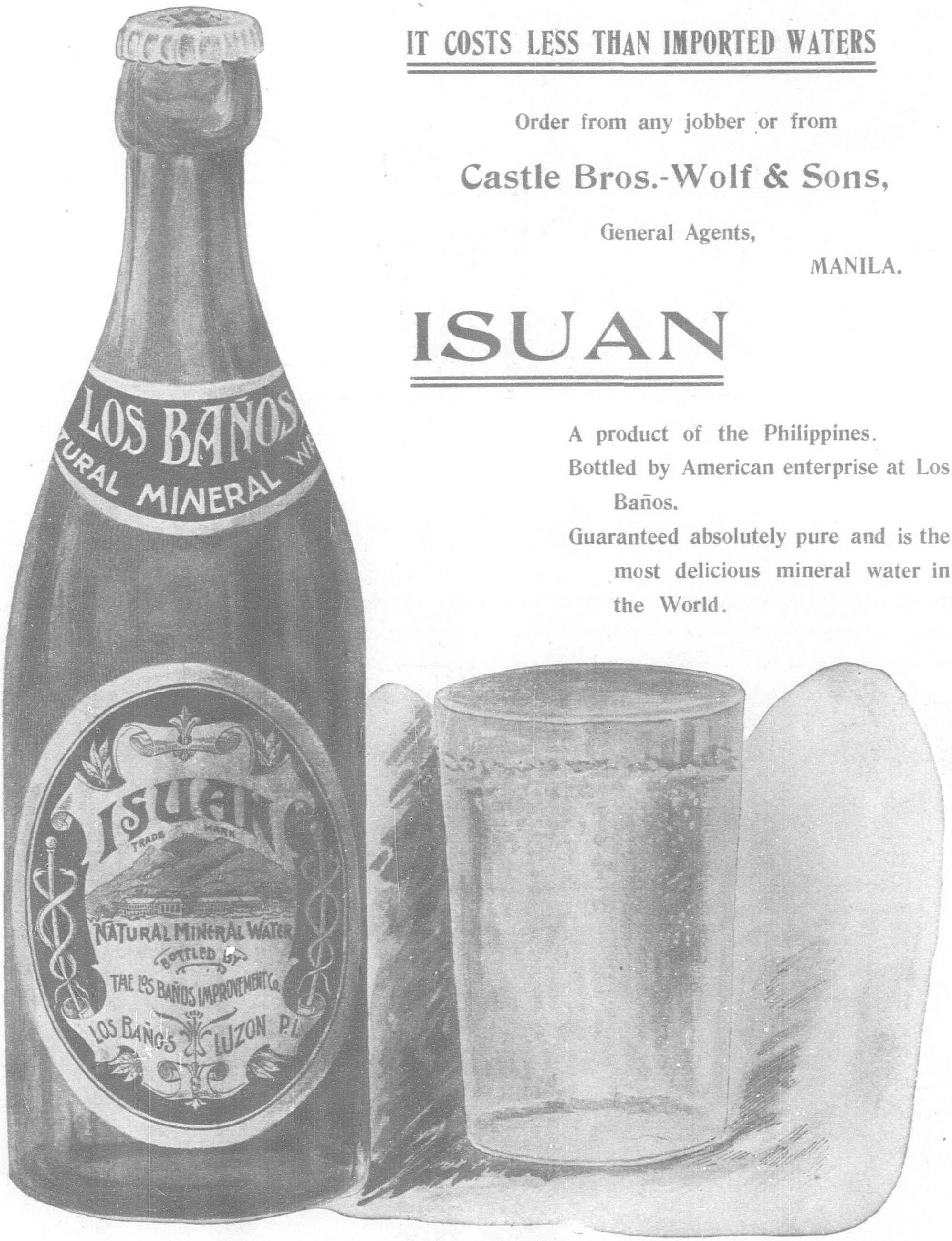

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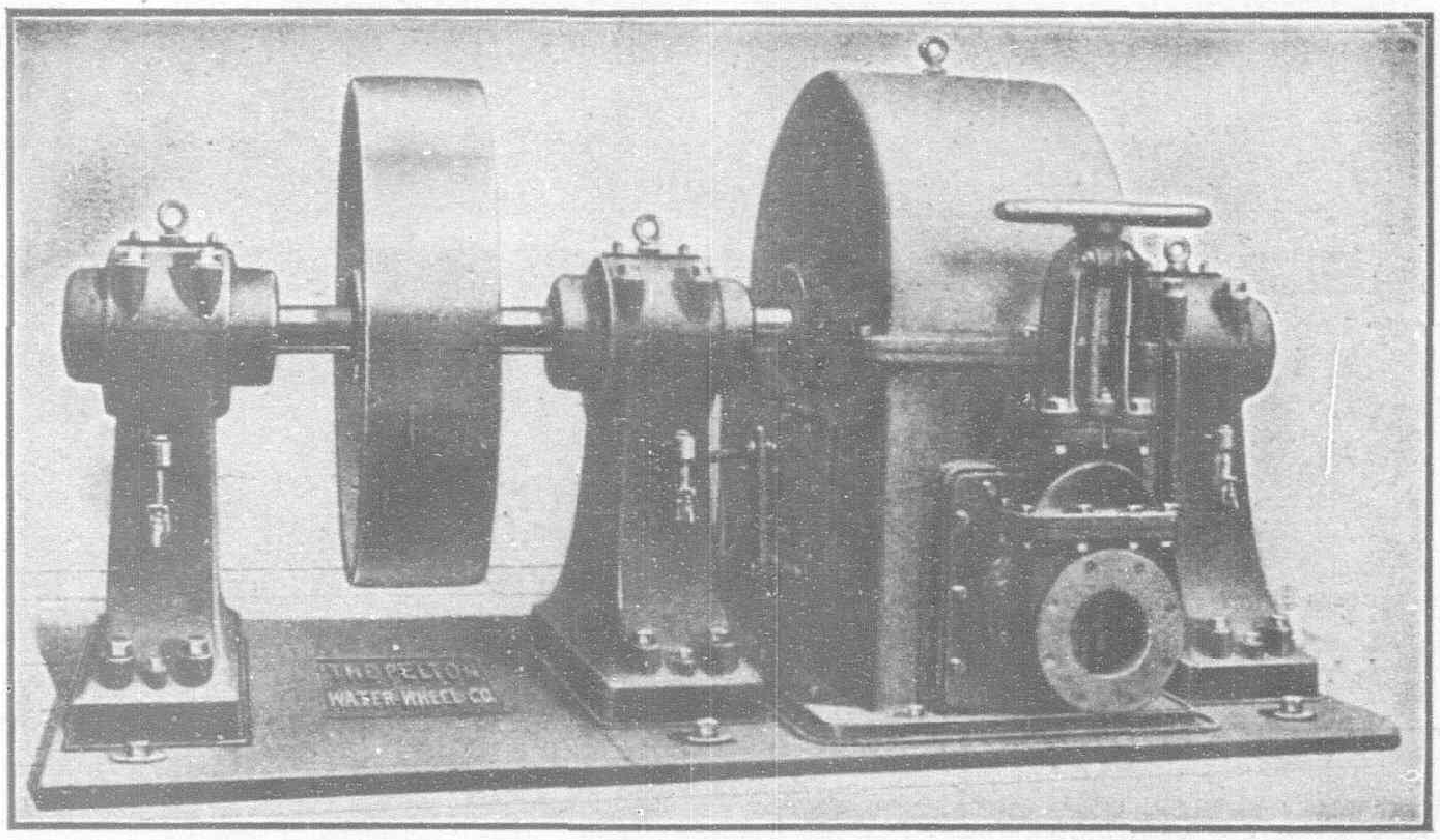

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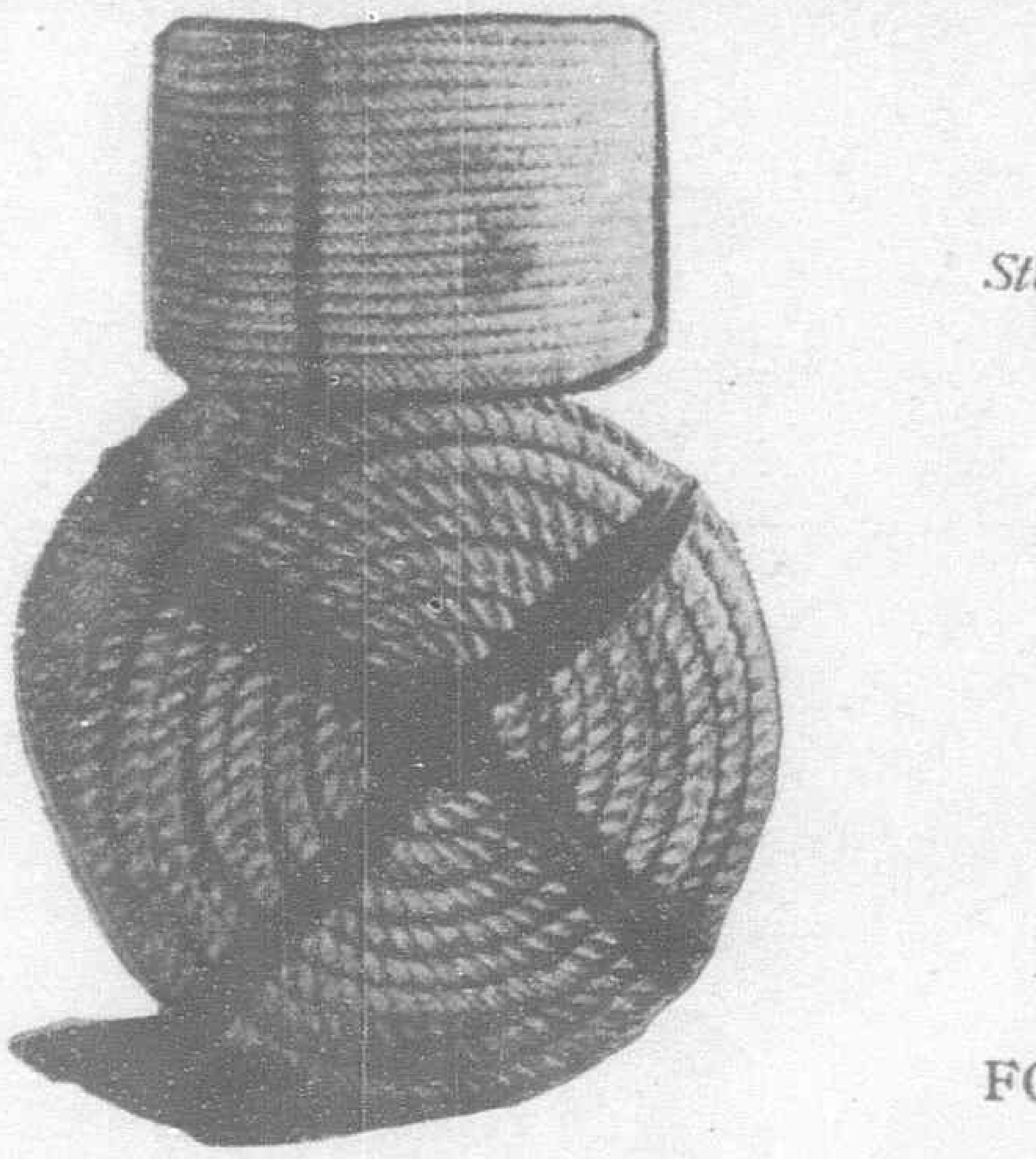

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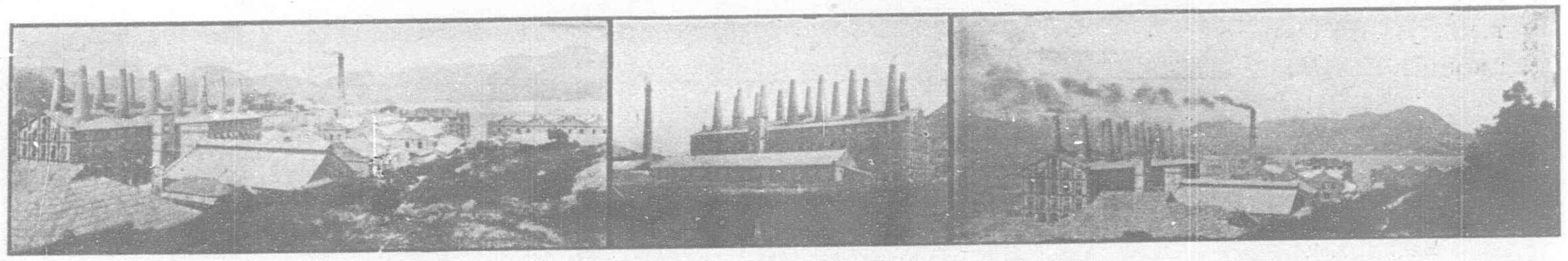

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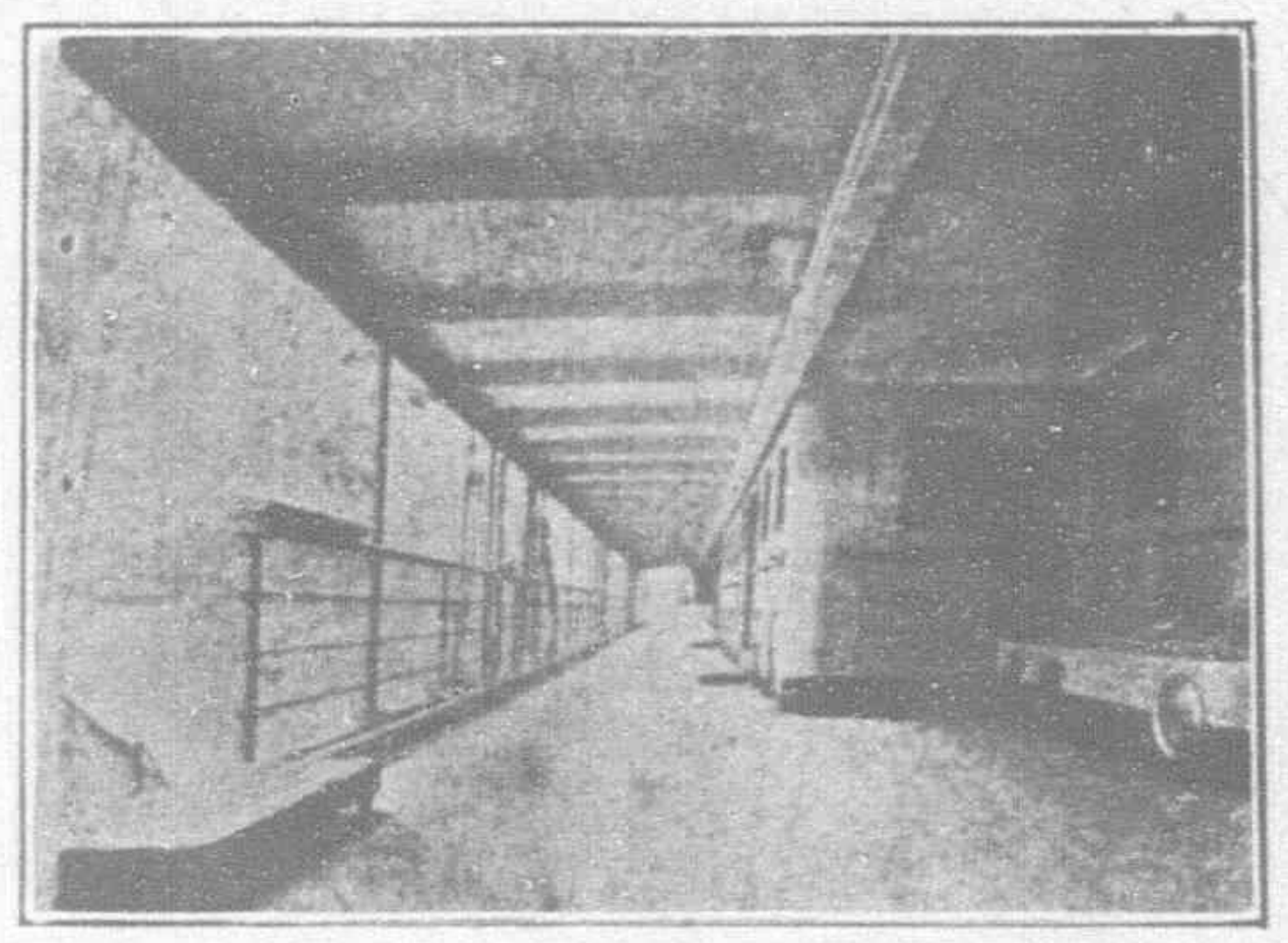

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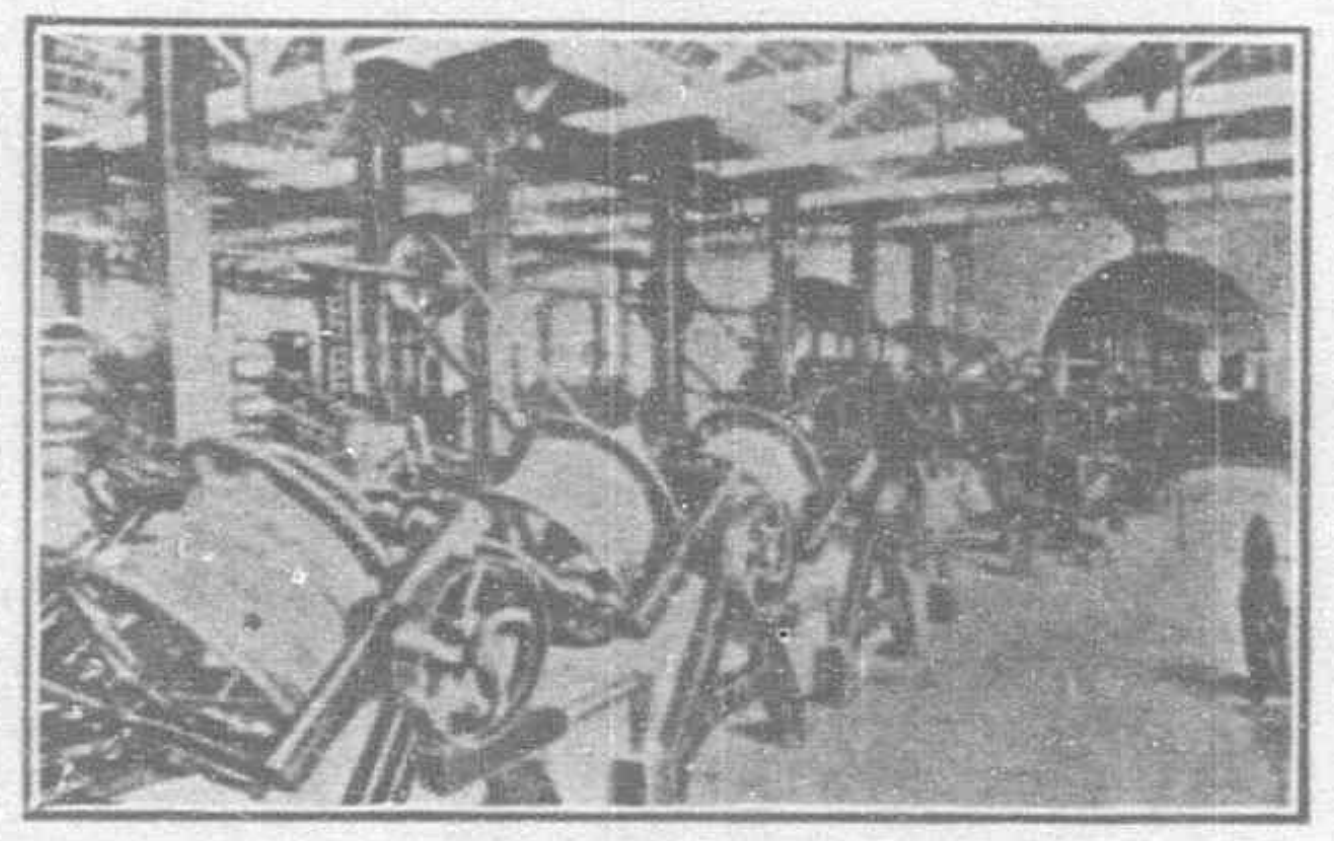

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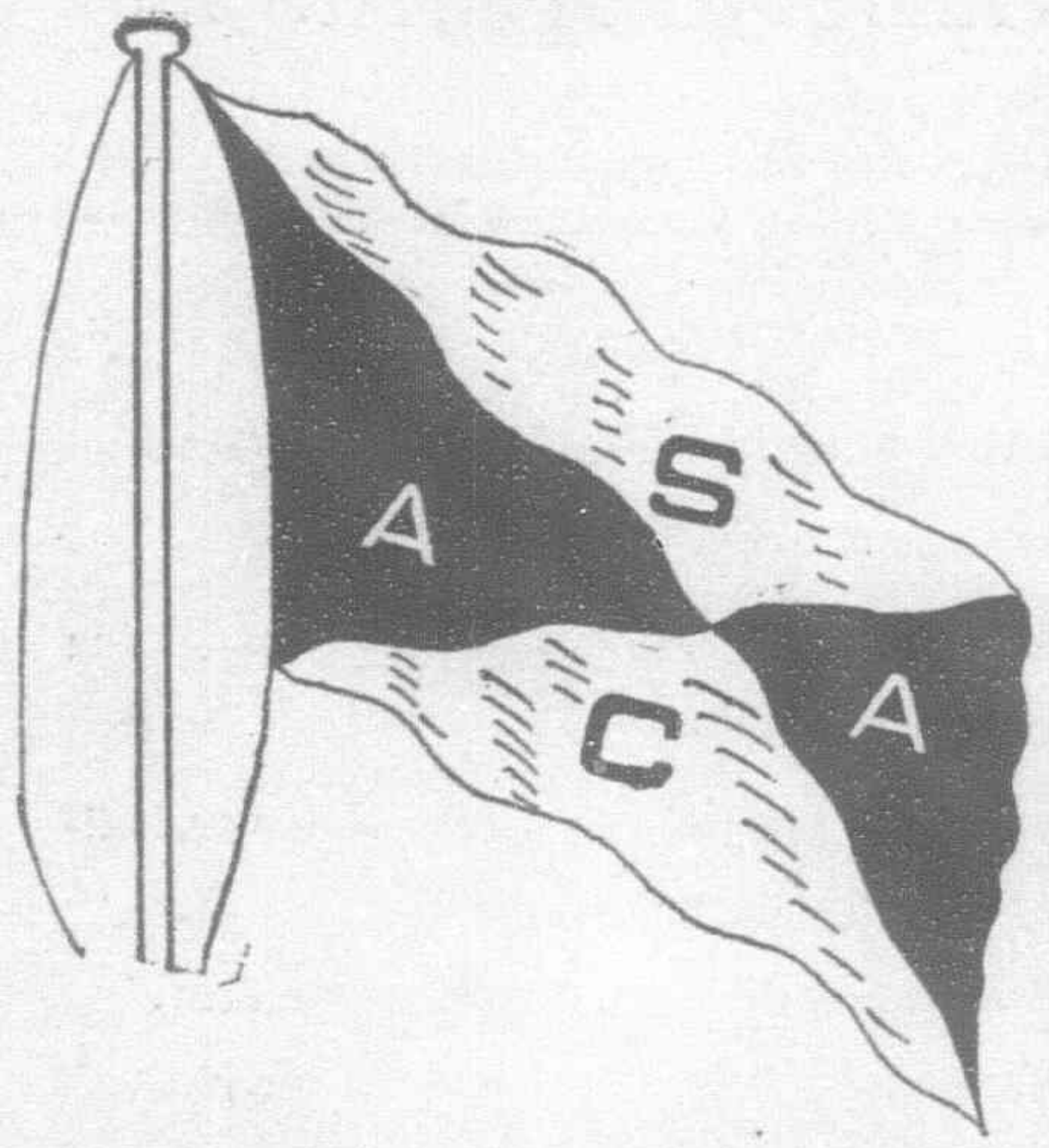

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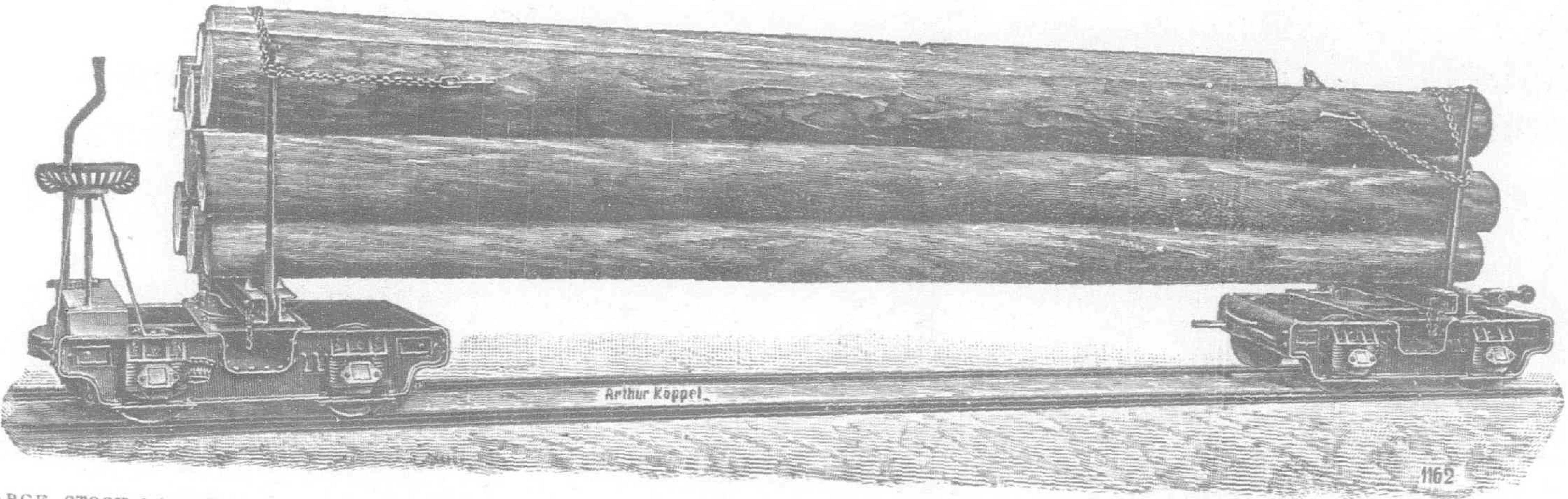

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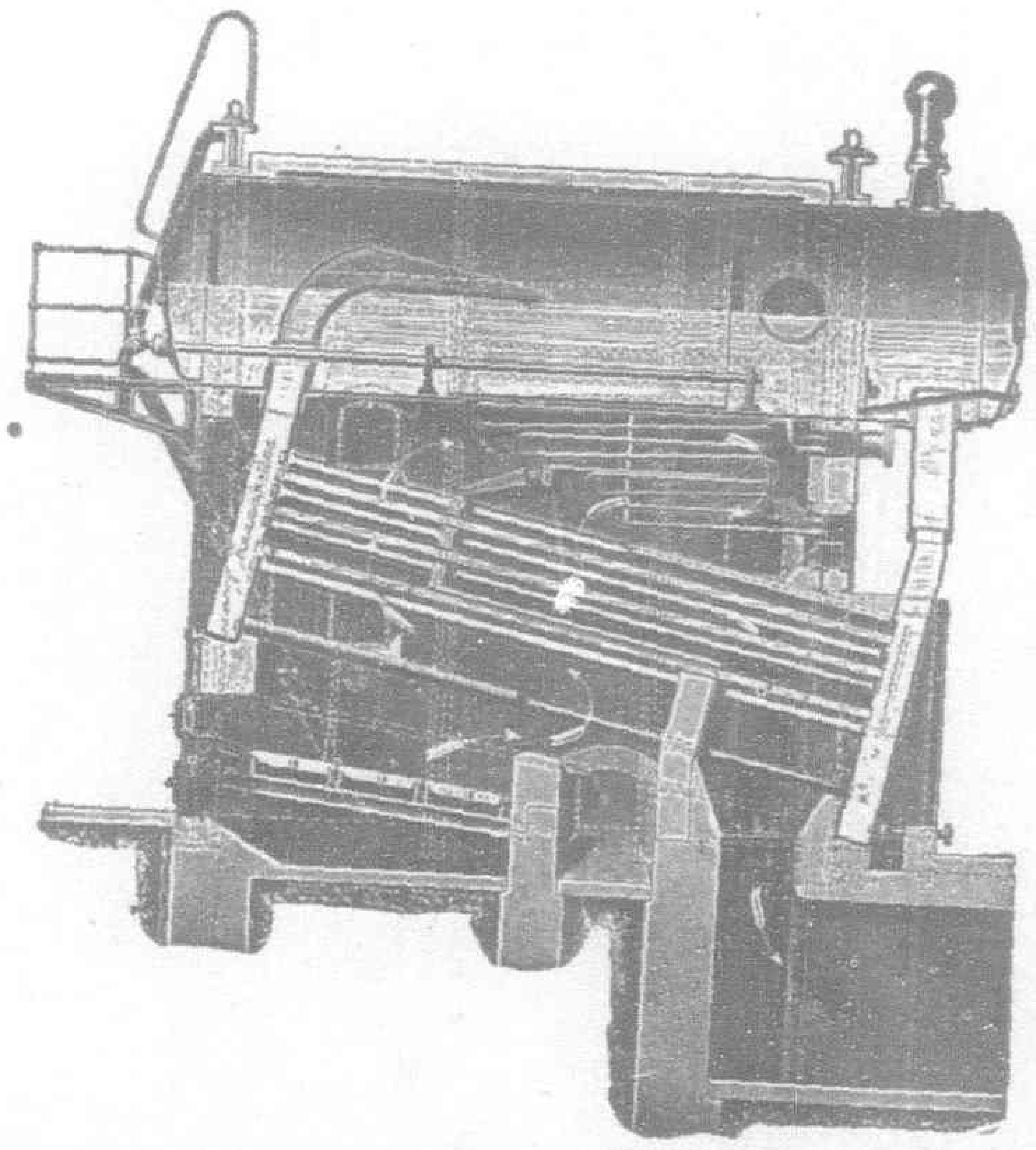

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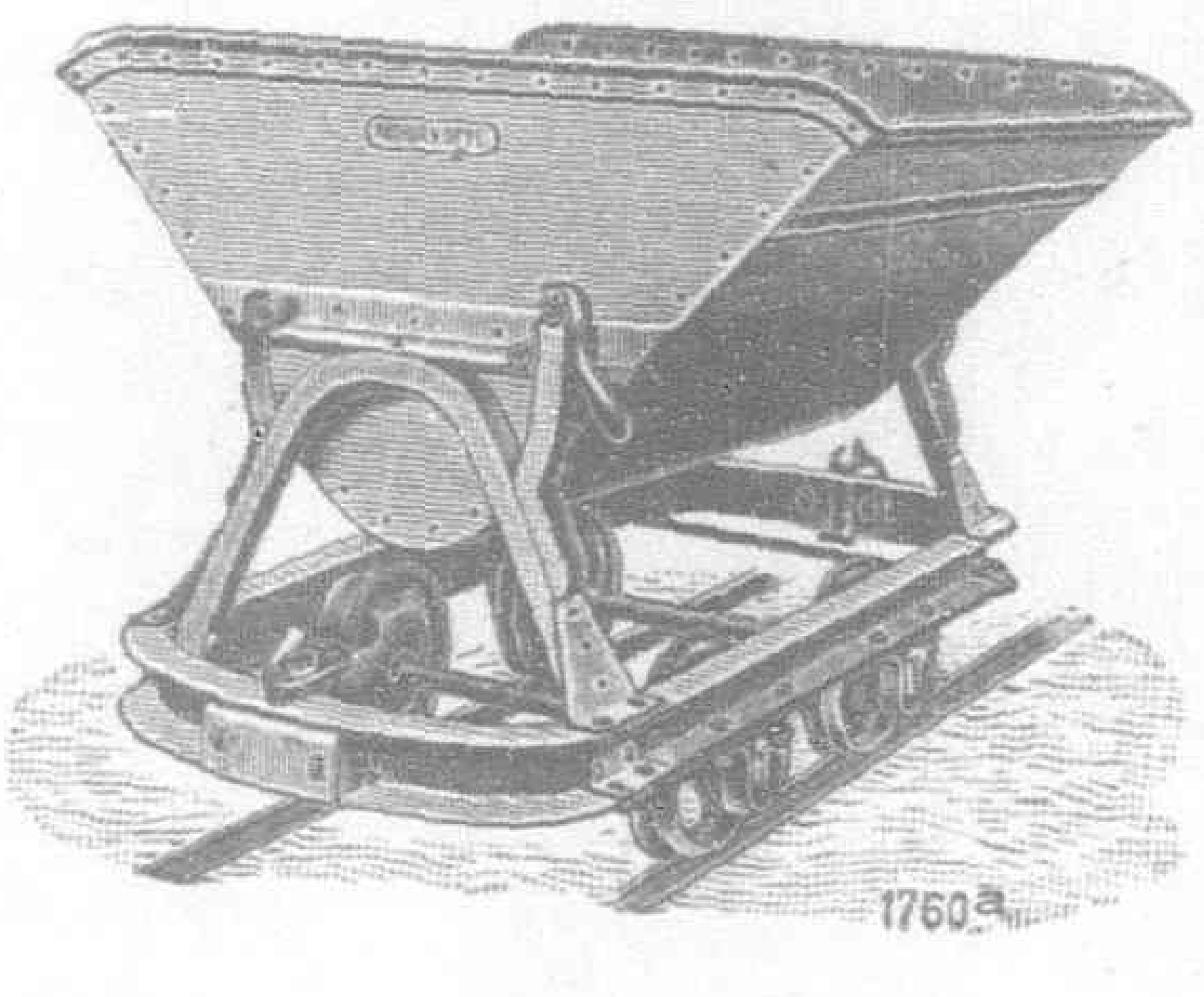

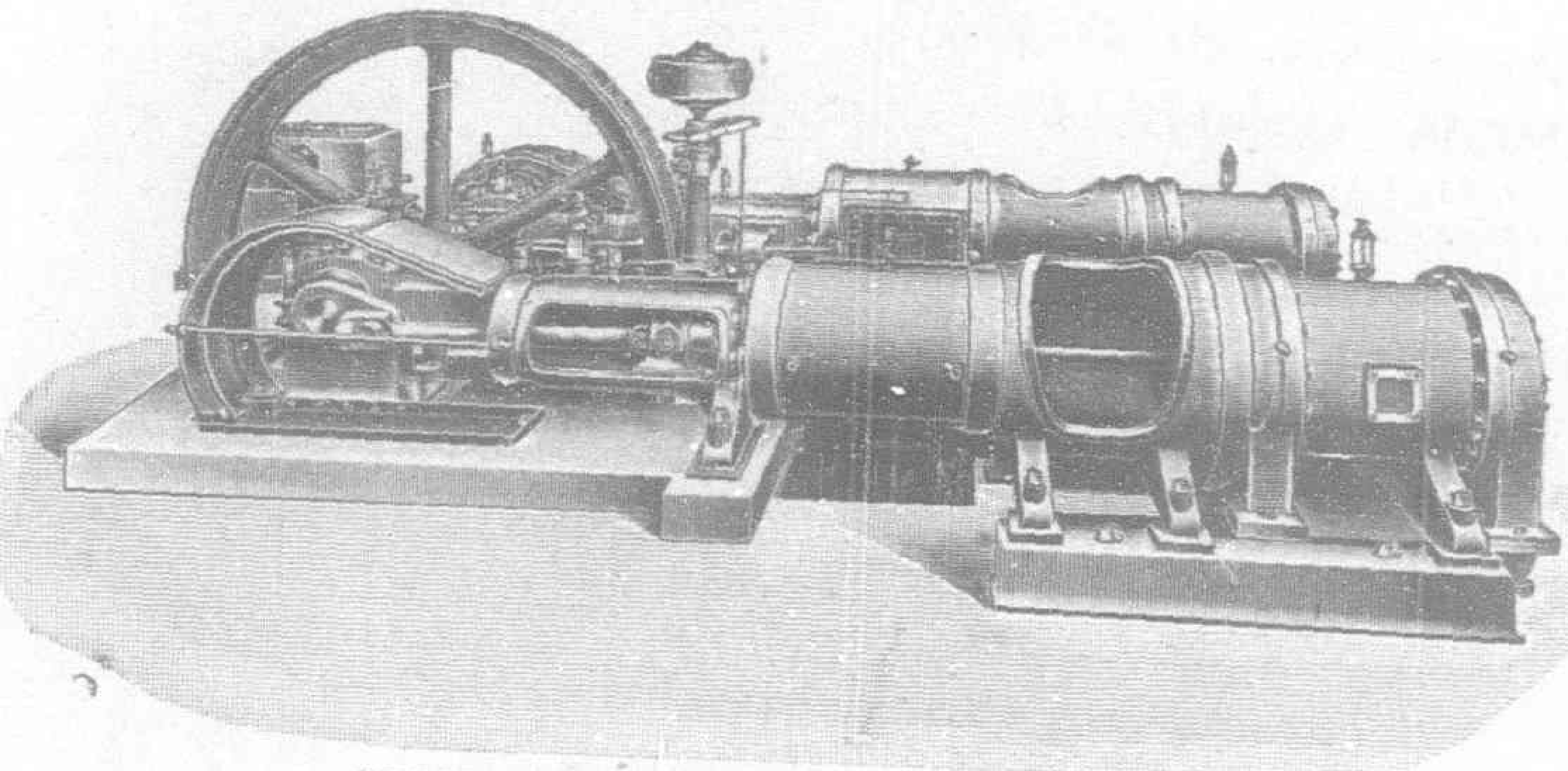

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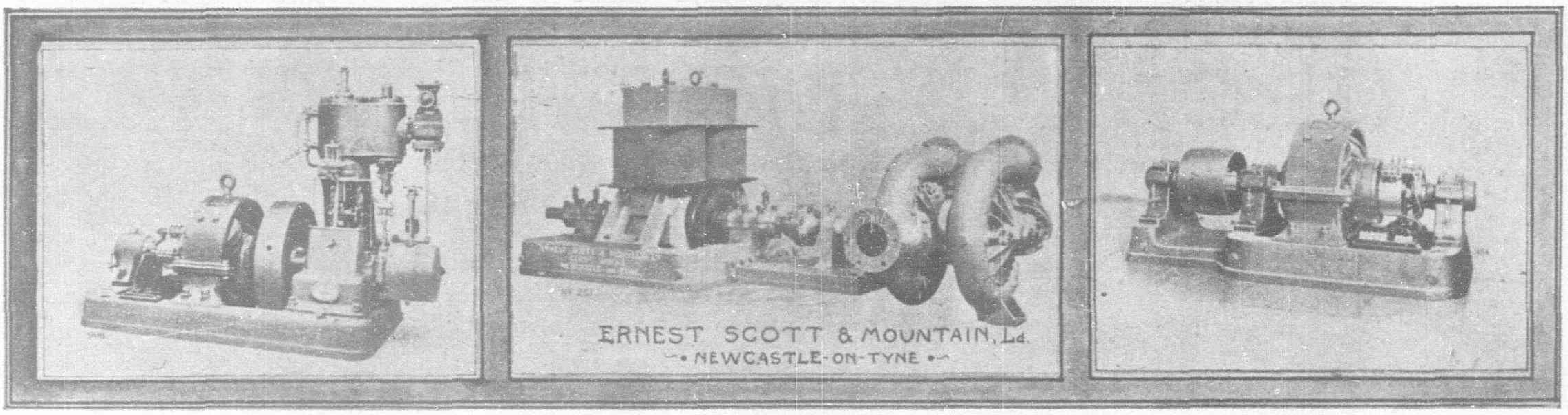

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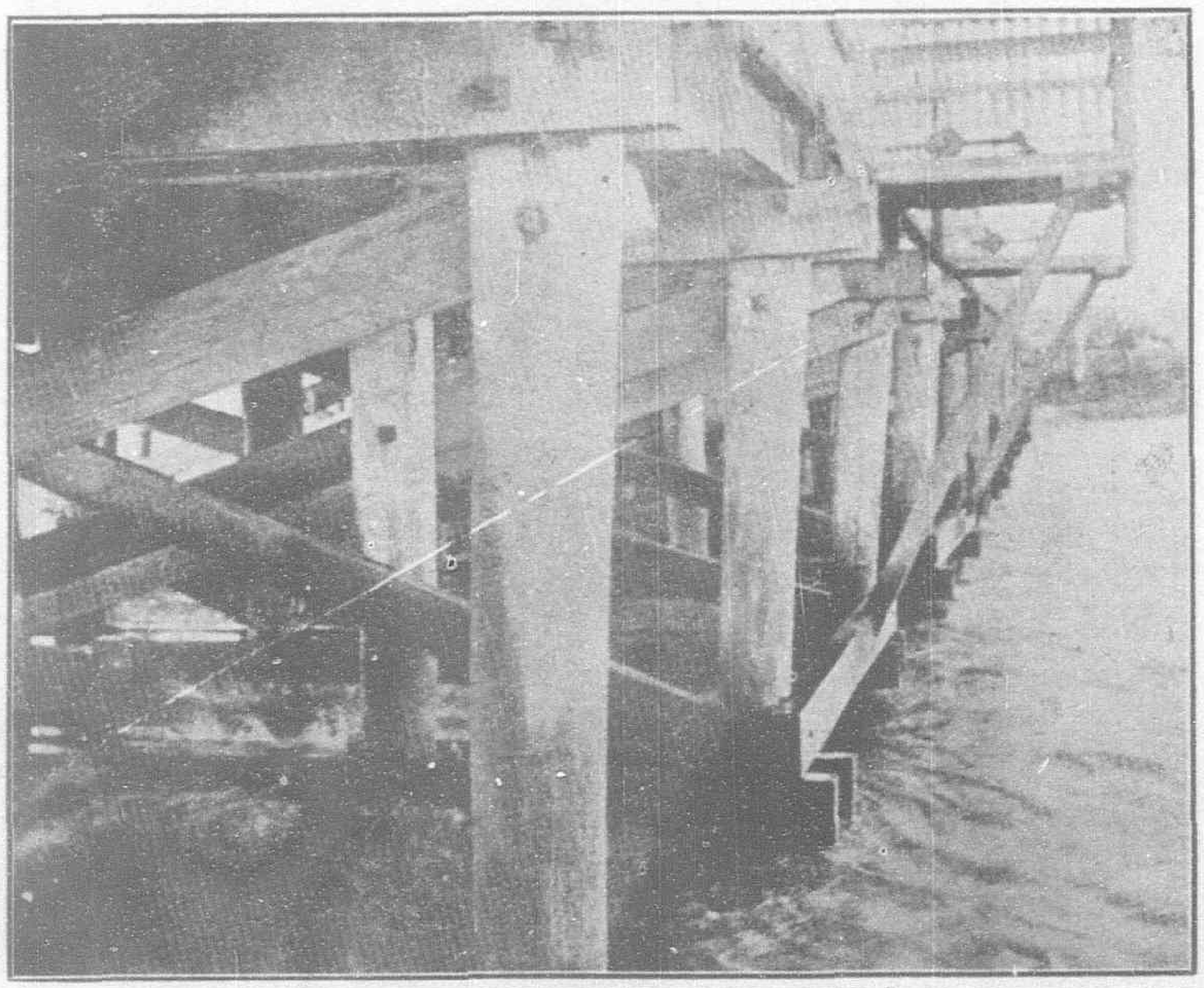

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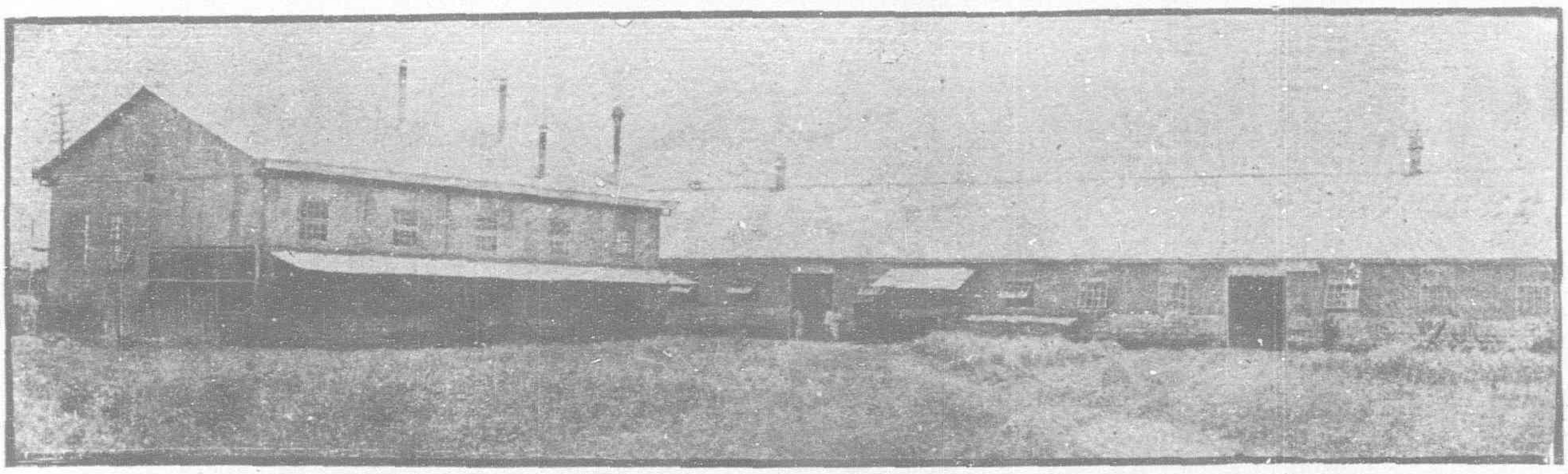

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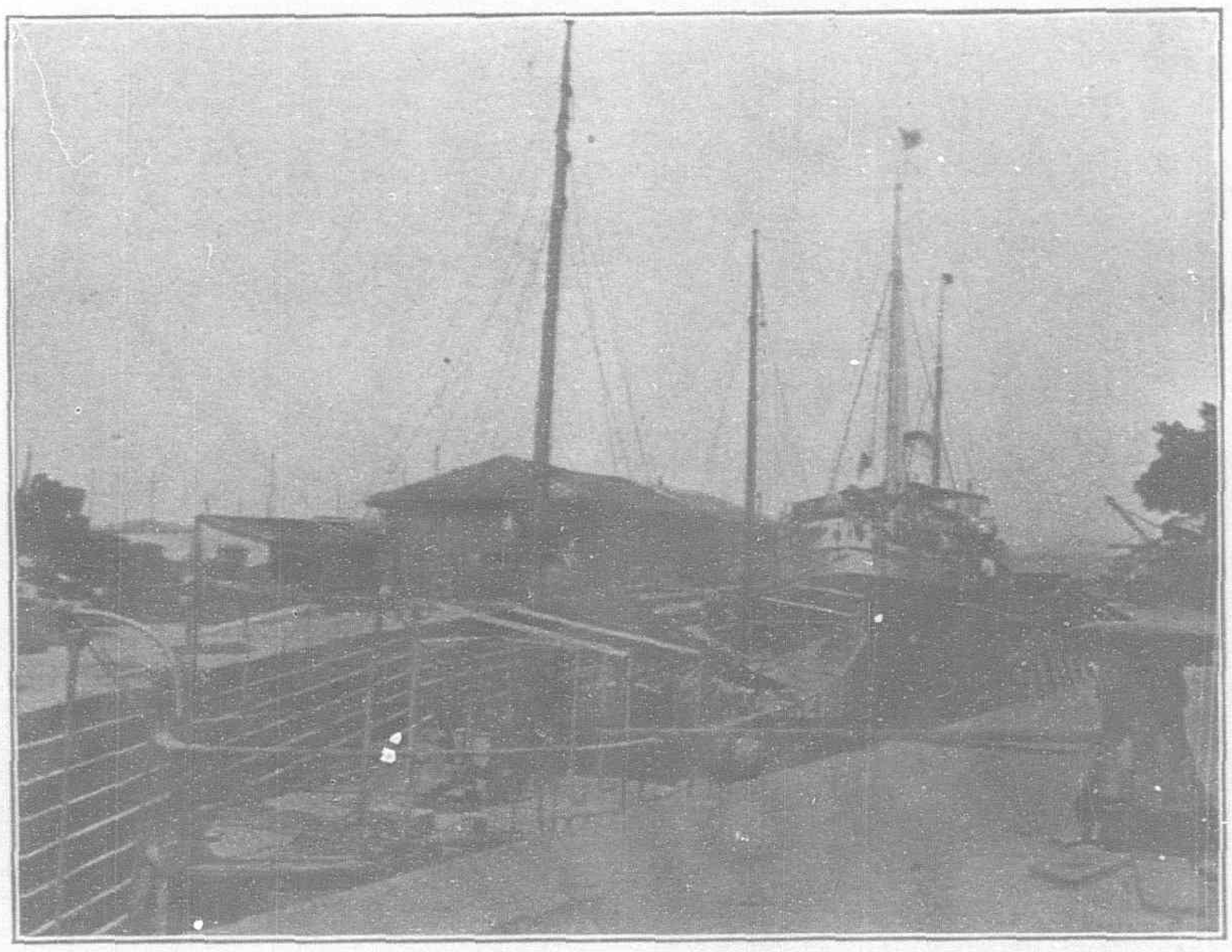

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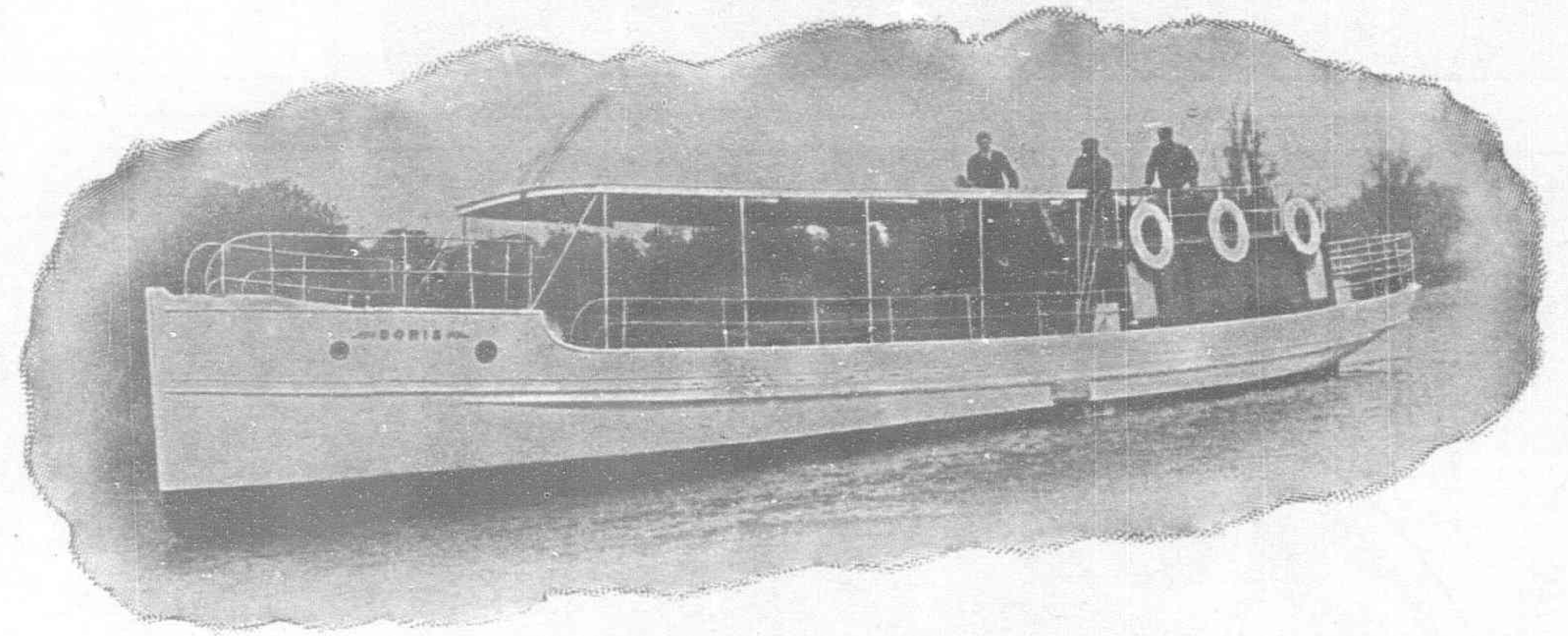

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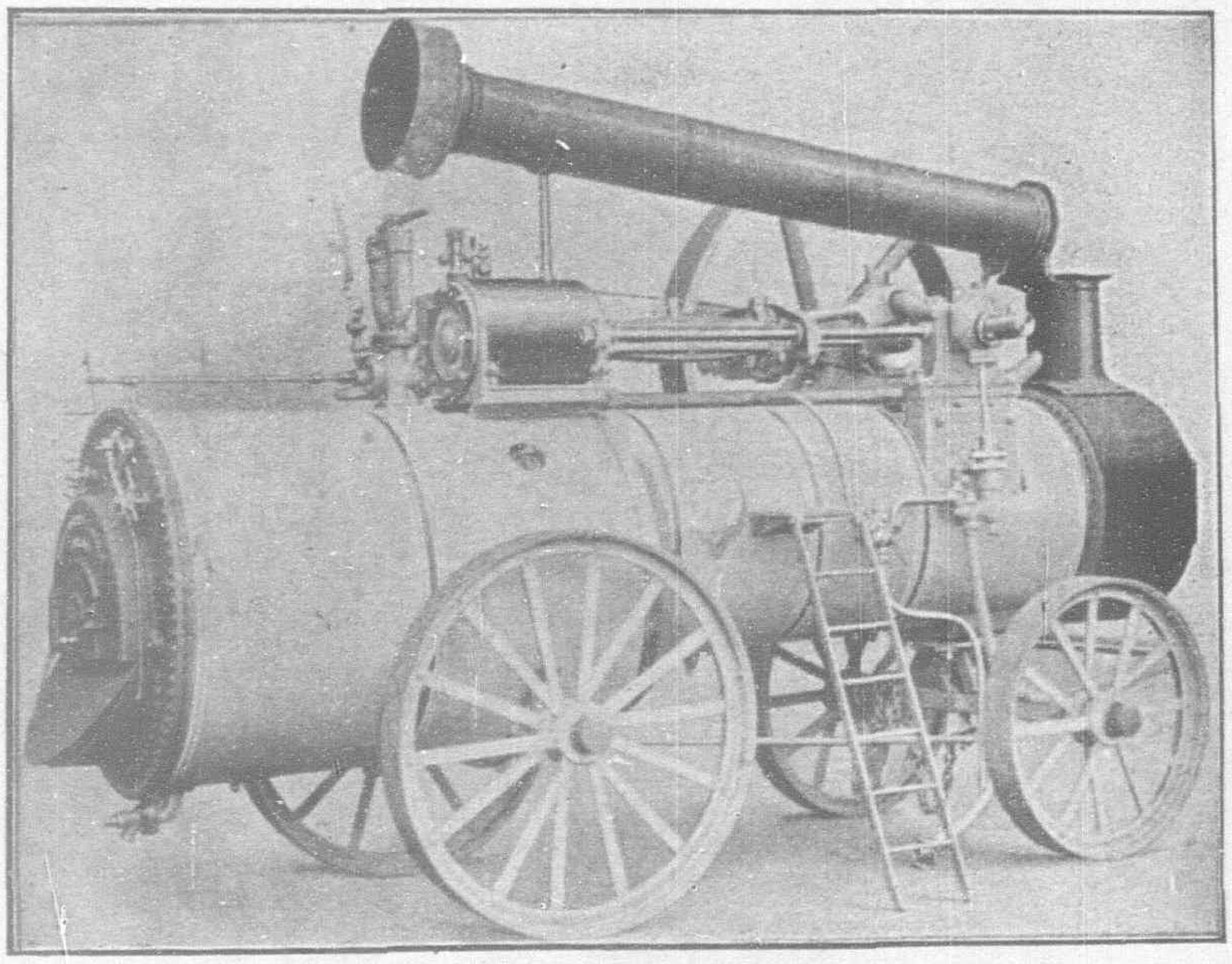

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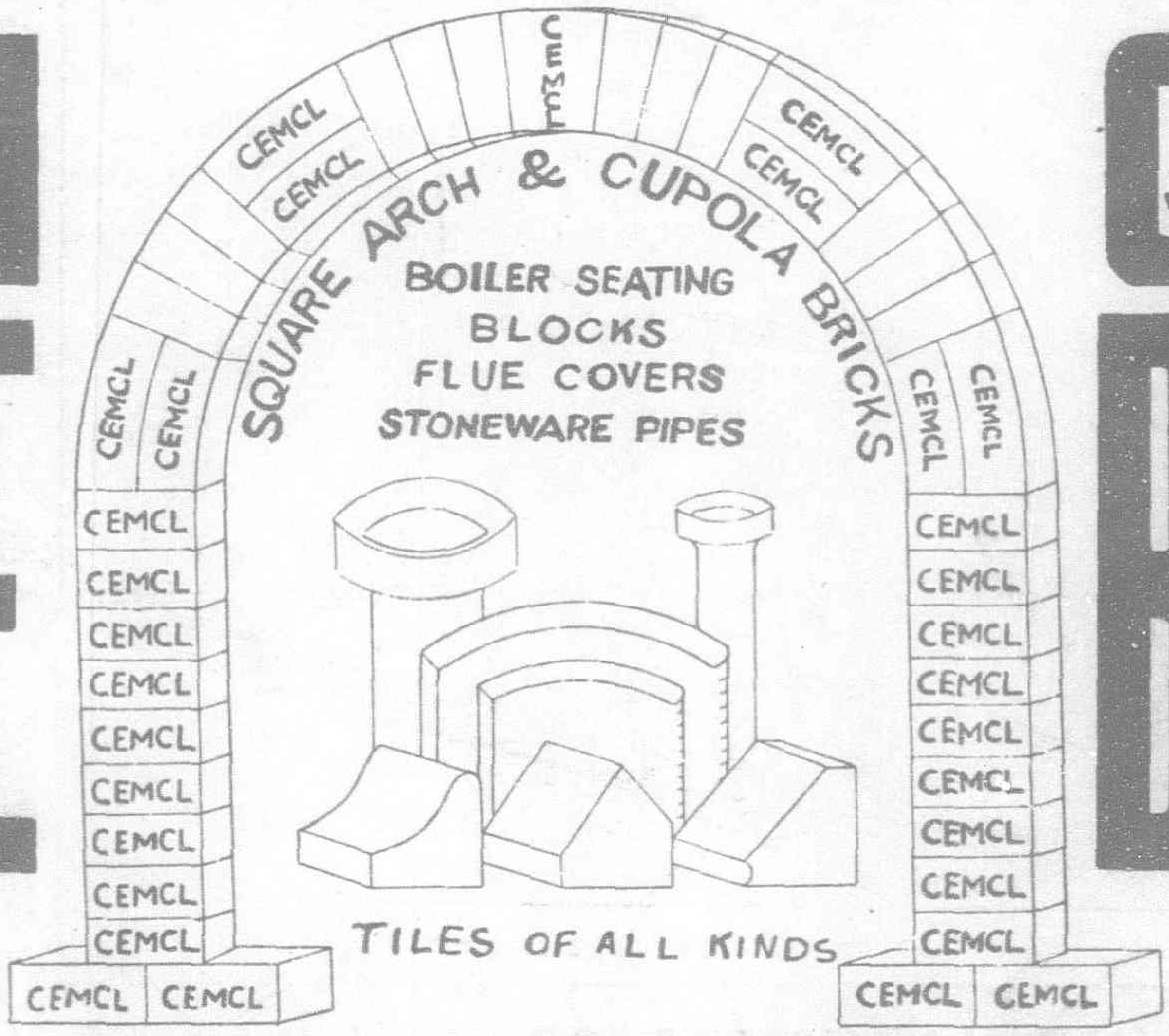

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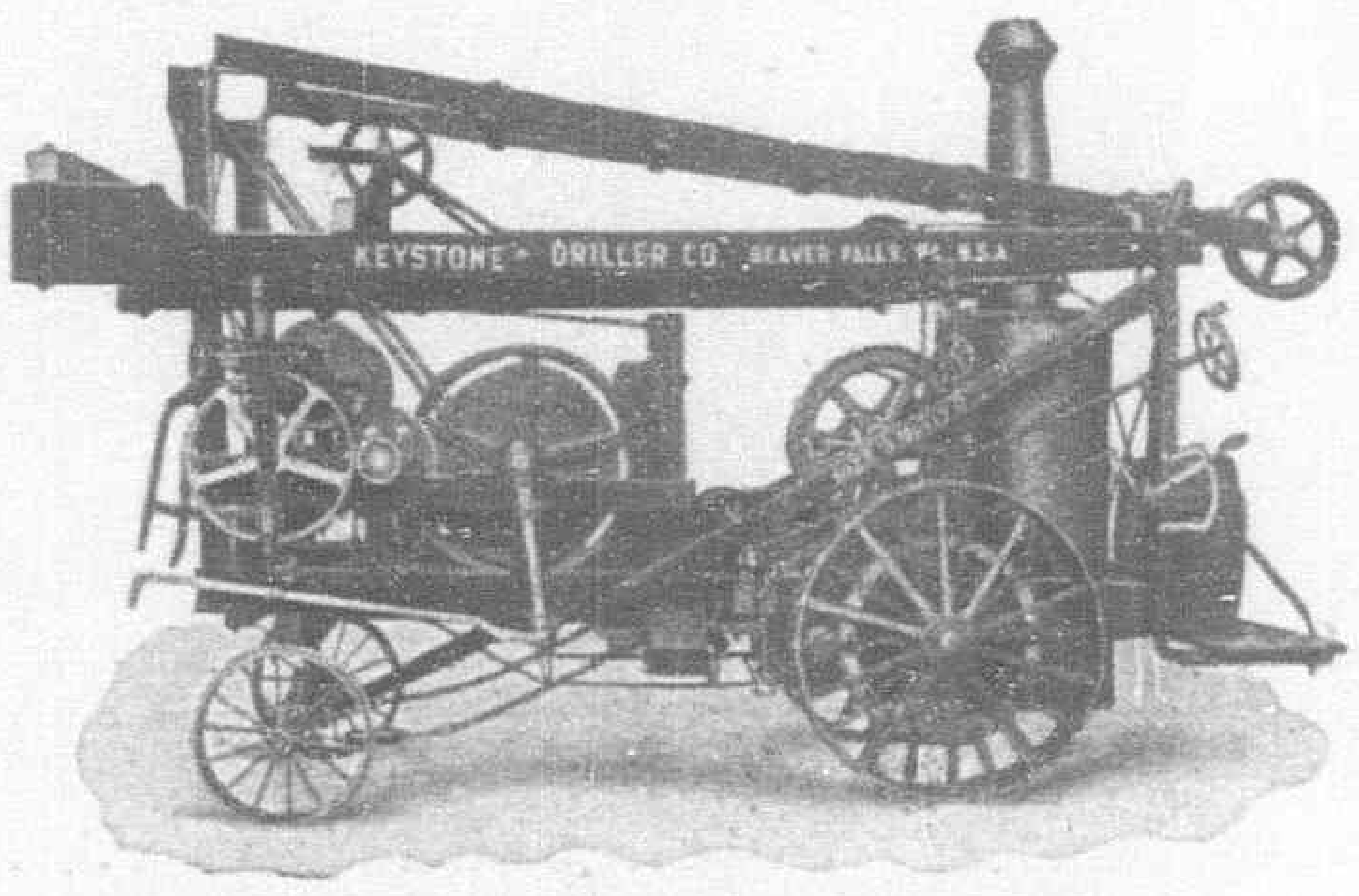
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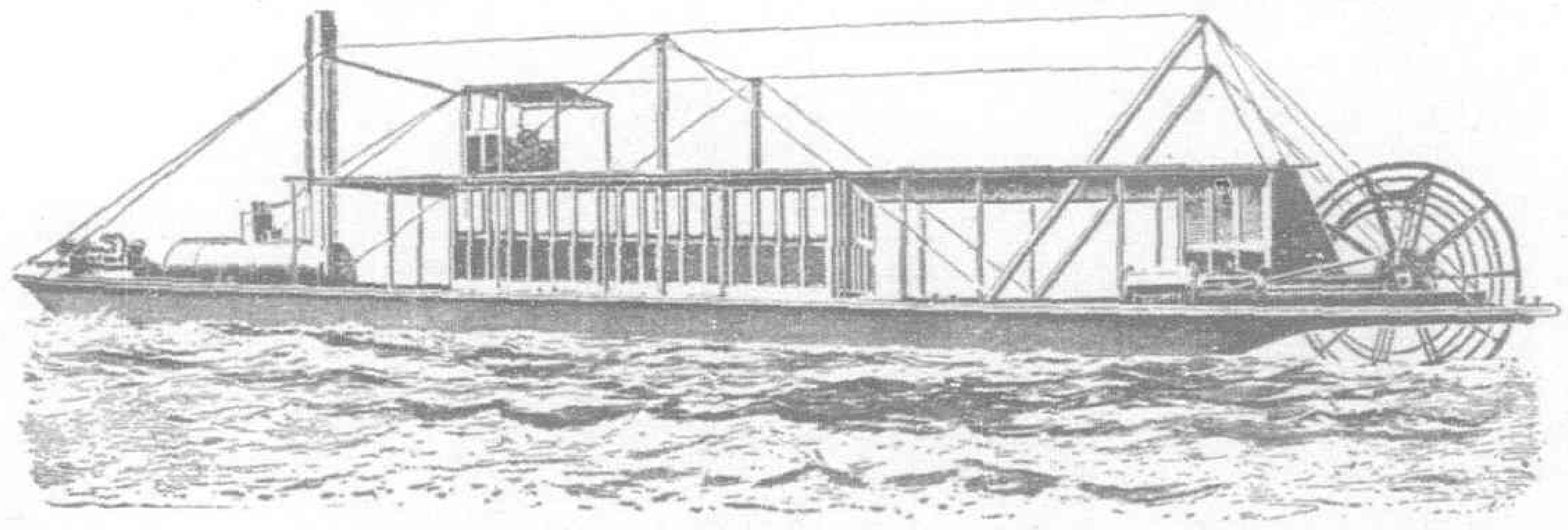

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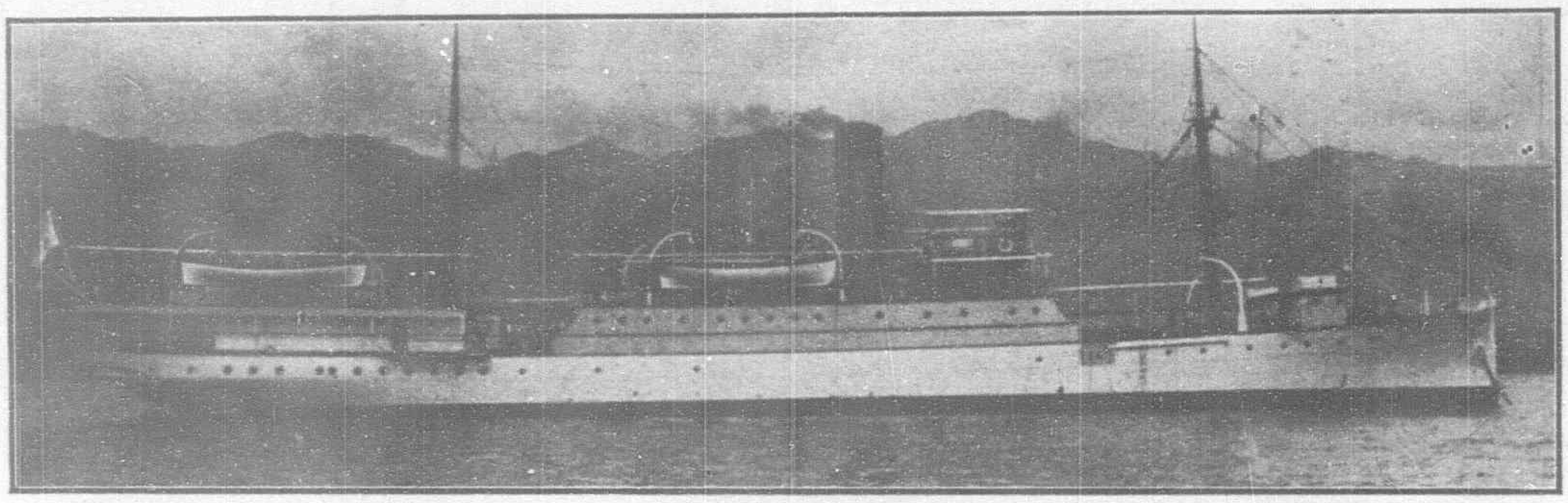

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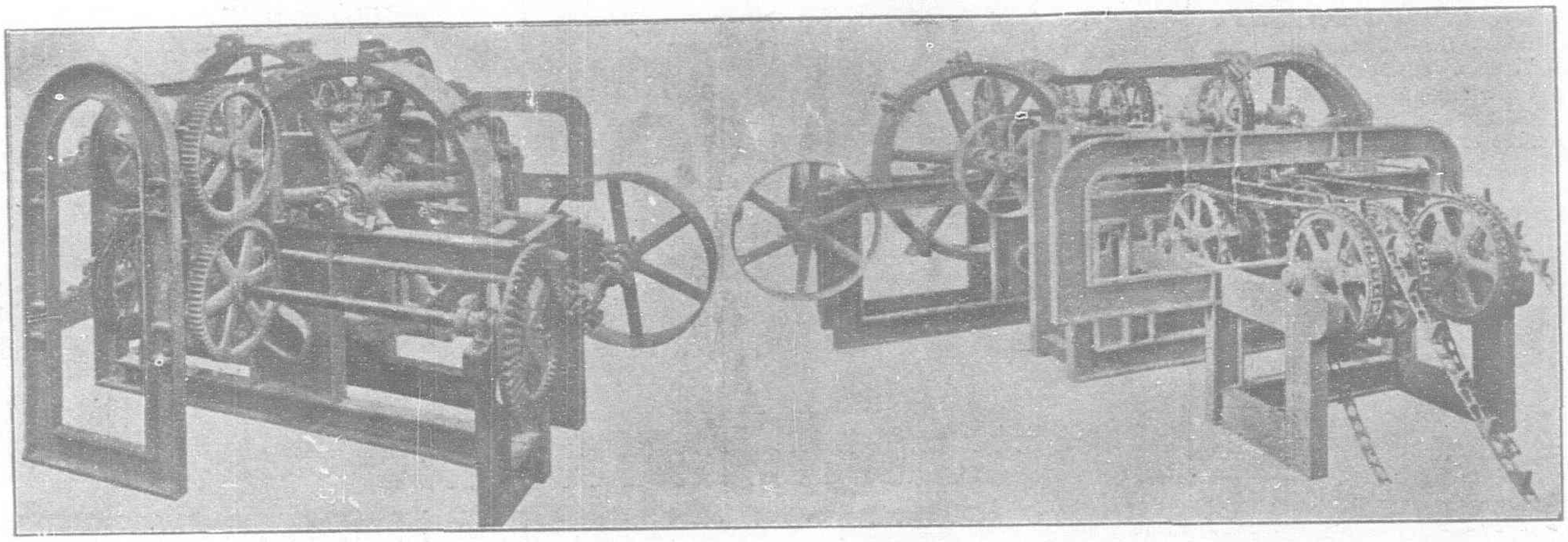

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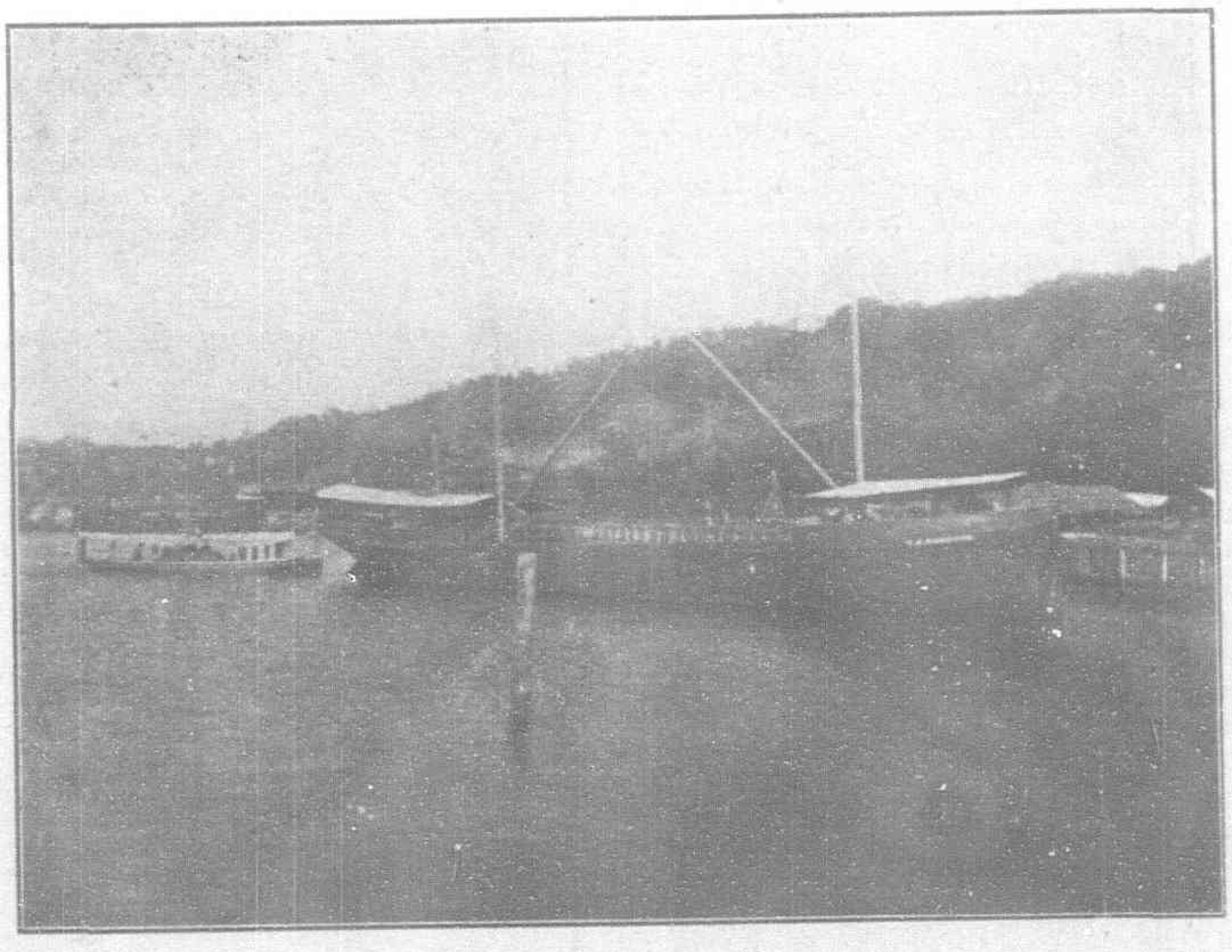

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DIRECTORS

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G. MORGAN, Vice-Pres. & Sec'y.
GAY W. PARSONS, Treasurer
THOMAS D. AITKEN
WILLIAM J. SHAW
BERNARD H. BERKENKOTTER

A. J. EVELAND
Mining Engineer and Manager

Organized 1901
Incorporated 1903
CAPITAL - $3,000,000.00

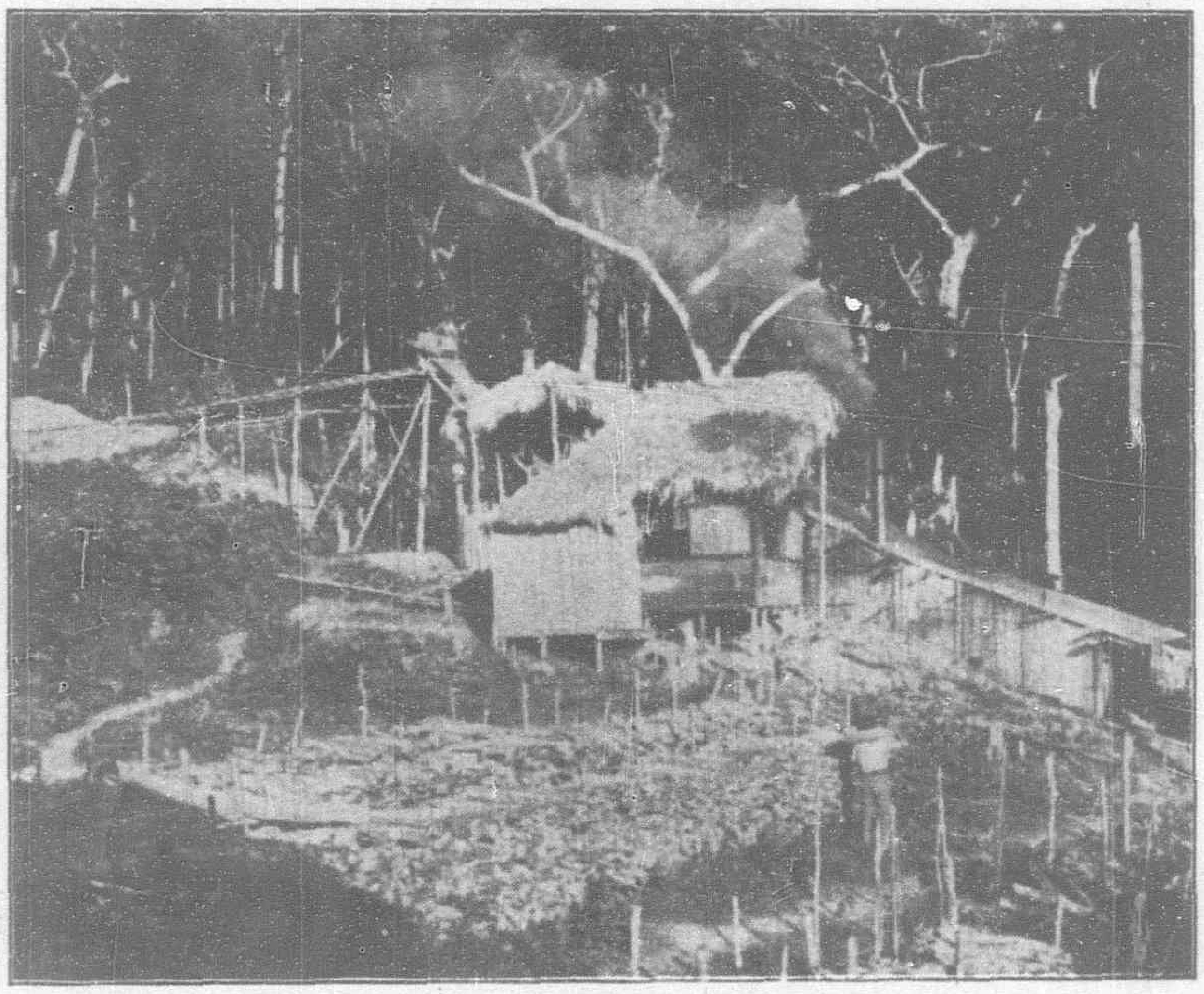
Cable: "GUINOBATAN," Manila
Code: Western Union

Eastern Mining Co.

INCORPORATED
Intern. Banking Corporation Building
PLAZA MORAGA
MANILA
P. I.

NEW YORK OFFICE
SUITE 514
49 & 51 WALL STREET
Tel., 6842 & 6843 Broad

INTERIOR OF "HAVE GOT" TUNNEL



VIEW OF MILL FROM VERANDA OF OFFICE BUILDING

The property of the Eastern Mining Company is the best developed of those in the Aroroy District, on the Island of Masbate, P. I.

From inspection trips of government officials, from preliminary investigations of the Mining Bureau of the Philippines, and from reports of Mining Engineers, it is conceded that the property is one that will the fullest degree, justify further development of the mine, and the installation of a suitable plant to treat the ore. There is ore enough "blocked out," in the full engineering significance of the term, to warrant the installation of a plant. From ore tests made by responsible engineers, it is found that there are no undue difficulties in the way of rapid and cheap treatment.

Conditions of mining on the property are excellent. The mines are opened by tunnels and are self-draining. There is ample height above the mine levels for the working of the ore bodies economically and by best methods.

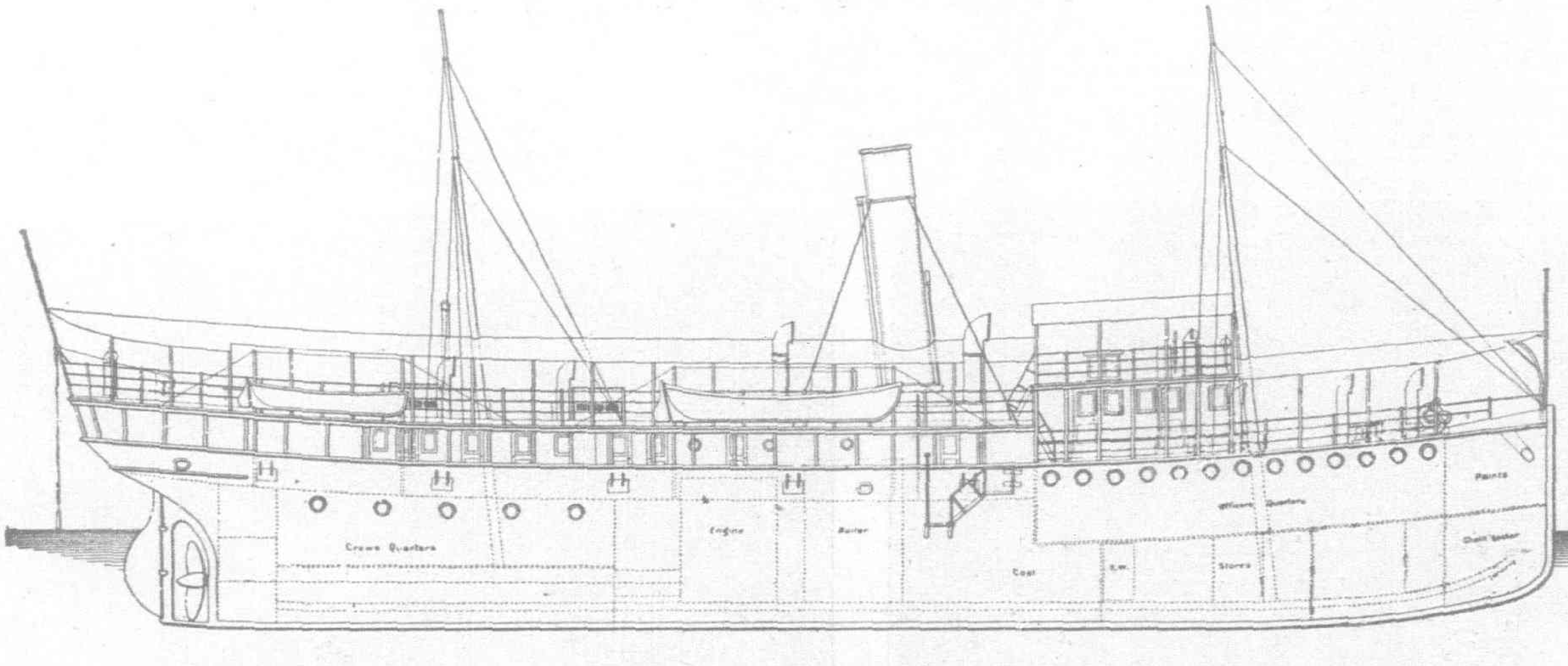
By careful and extensive sampling the values of the ore bodies are assured, and the mine shows ore that can be handled at a handsome profit. The results of the experimental plant show conclusively that estimates and figures are correct and that now the Company is assured of success, by the proper exploitation of the property.

What is needed now is a large milling plant with its increased mine development and for this purpose—for the expansion of the present well proven concern into a large producer,—**a limited amount of treasury stock is offered investors at a low figure, for providing the necessary capital to purchase and install a new 40-stamp mill. For particulars and information apply to either Manila or New York Office.**

Hongkong & Whampoa Dock Co., Ltd.

ENGINEERS, BOILERMAKERS, FOUNDERS, SHIP BUILDERS AND DOCK OWNERS

...HONGKONG...



U. S. COAST & GEODETIC SURVEY STEAMER "FATHOMER" BUILT BY THE HONGKONG AND WHAMPOA DOCK CO., LTD., FOR THE UNITED STATES GOVERNMENT, FOR SERVICE IN THE PHILIPPINES

THE COMPANY'S DOCKS at KOWLOON, TAI-KOK-TSUI and ABERDEEN are in efficient working order, and the attention of Captains and Shipowners is respectfully solicited to the advantages which these Establishments offer for Docking and Repairing Vessels.

The Company has SIX GRANITE DOCKS and TWO PATENT SLIPS of the following dimensions:—

NAME OF DOCK OR SLIP	LENGTH ON KEEL BLOCKS	BREADTH AT ENTRANCE	DEPTH OVER SILL AT ORDINARY SPRING TIDES	RISE OF TIDE	
				SPRINGS	NEAPS
KOWLOON	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
No. 1 Dock, Kowloon	576	86 feet top 70 ft. bottom	30′	7′ 6″	3
No. 2 Dock, Kowloon	371	74′	18′ 6″	7′ 6″	—
No. 3 Dock, Kowloon	264	49′ 3″	14′	7′ 6″	—
Patent Slip, No. 1, Kowloon	240	60′	14′	7′ 6″	—
Patent Slip, No. 2, Kowloon	220	60′	12′	7′ 6″	—
TAI-KOK-TSUI					
Cosmopolitan Dock	466	85′ 6″	20′	7′ 6″	—
ABERDEEN					
Hope Dock	430	84′	23′	7′ 6″	—
Lamont Dock	333	64′	16′	7′ 6″	—

The DOCKS are fitted with every appliance in the way of Caissons powerful Centrifugal Steam Pumps, etc., which enable them to be pumped out in three hours.

WORKSHOPS.—The extensive workshops on the premises at Kowloon, Cosmopolitan, and Aberdeen Docks possess every facility and appliance necessary for the repairs of ships and steam machinery. The Engineers' Shops are supplied with a large plant of the latest types of tools in the way of Lathes, Planing, Milling and Screwing Machines, Electric Cranes, etc., etc., and capable of executing the largest class of work with despatch. The Shipwrights' Department has attached to it a Steam Sawmill with Circular, Vertical and Band Saws, and also a complete plant of Wood-working Machinery of the most modern and improved type. The Blacksmiths' Shops are equally well furnished with a complete supply of powerful Steam Hammers, Cranes, etc., capable of forging stern posts and crank and straight shafting of the largest size.

Powerful Lifting Shears with steam purchase at two of their Establishments stand on a solid granite seawall, alongside which vessels can lie drawing 24 feet of water, and take in or out boilers, etc. The Shears at Kowloon are capable of lifting 70 tons.

The Company is prepared to tender for the construction of new vessels in either steel, iron or wood, having already built about 400 of varying sizes up to 3,000 tons; also to execute all kinds of ship work at lower rates and with greater despatch than any establishment in the East. Every department is under the close supervision of experienced European foremen.

SHIP-YARD is fully equipped with modern plant, including hydraulic flanging and bending machines, electrically driven rolls, punching, shearing, angle-bevelling, joggling and planing machines, capable of dealing with the heaviest class of work.

BOILER-MAKERS' DEPARTMENT.—The Company, in addition to executing repairs, is prepared to tender for new boilers to steamships for the construction of which it possesses special facilities, including powerful punching and shearing machines, hydraulic rivetters, etc.

FOUNDRY.—The Foundry is fitted with a large powerful Steam Crane and the Cupolas are capable of casting up to 100 tons. The Company is prepared to supply the very best iron and Brass Castings of all descriptions upon the shortest notice.

GALVANIZING PLANT of the most modern type by electrical deposit has been put up at the Kowloon Establishment, which is capable of doing the largest class of work.

STORES.—The Company's Godowns contain large and well-selected stocks of all material and fittings requisite in shipbuilding, engine-room outfits, furnishings, and ships' stores of all descriptions supplied at tariff rates.

For Further Particulars apply at the Offices of the Company, Queen's Buildings, No. 1, New Praya, Hongkong, or to

FINDLAY & CO., Agents, Manila, P. I.

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Codes Used:
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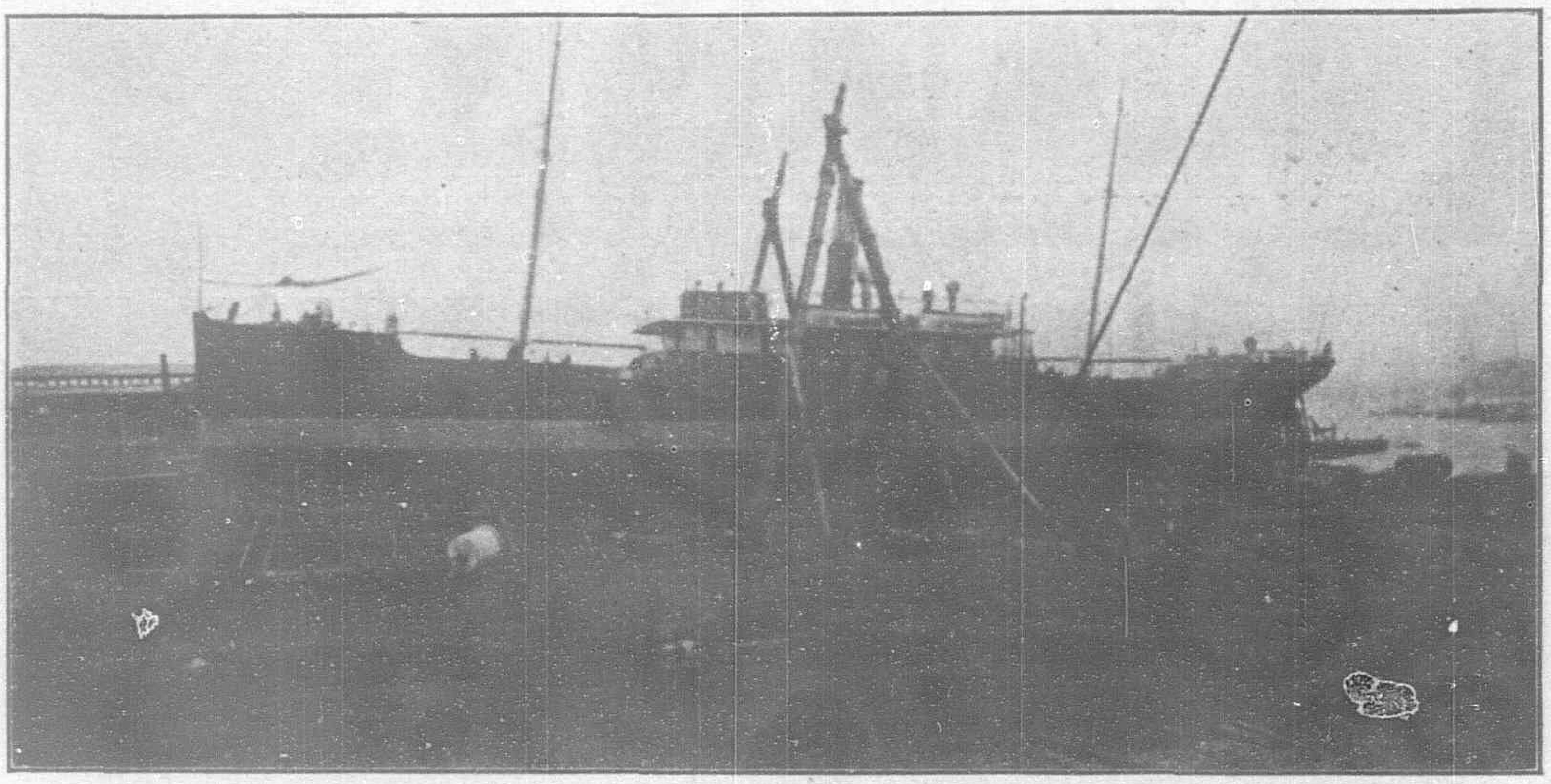
(Late S. C. Farnham, Boyd & Co., Ltd.)

SHANGHAI, CHINA

Dock Owners, Engineers, Founders, Boilermakers, Shipbuilders, and Electricians



CHINA MERCHANTS' S. N. CO.'S STEEL SCREW STEAMER "HSINKONG."

THE DOCKS

The Docks are five in number ranging in length from 360 feet to 560 feet, and breadth of entrance from 57 feet to 83 feet, with the depth of water on the sill from 16 feet to 24 feet.

The Dock charges are very moderate.

The Water Frontage is about 1½ miles in length. Wharves and Pontoons are arranged where steamers can moor during repairs; and slips for hauling up small vessels are provided. Sheer legs capable of lifting 65 tons are placed at the various Docks.

The extensive shipbuilding yards and workshops are provided with the latest improvements in tools, traveling cranes of 70 tons' capacity, hydraulic and pneumatic machinery.

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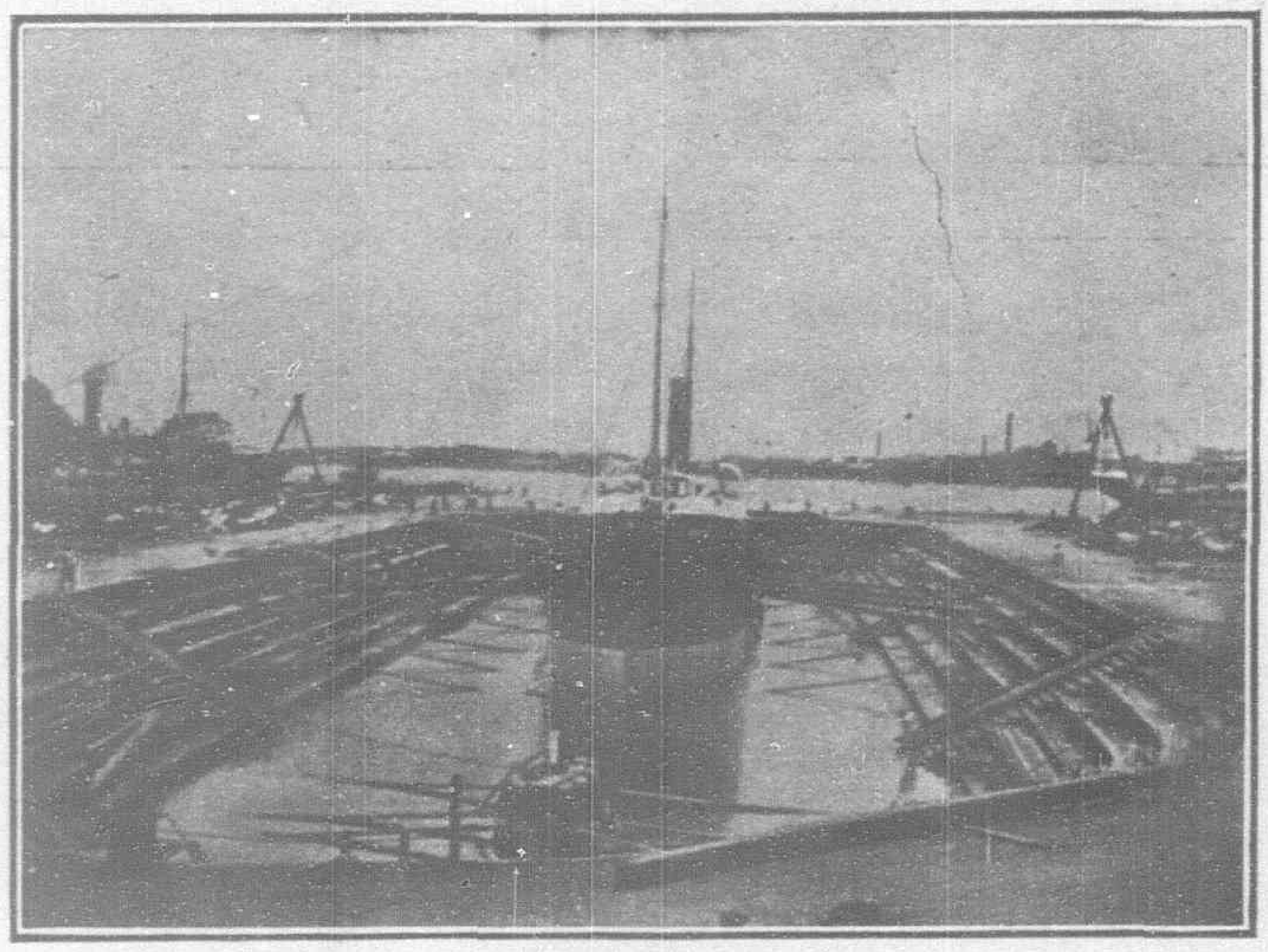

NEW DOCK AT POOTUNG

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Powerful salvage appliances can be supplied at short notice. Enquiries immediately attended to.

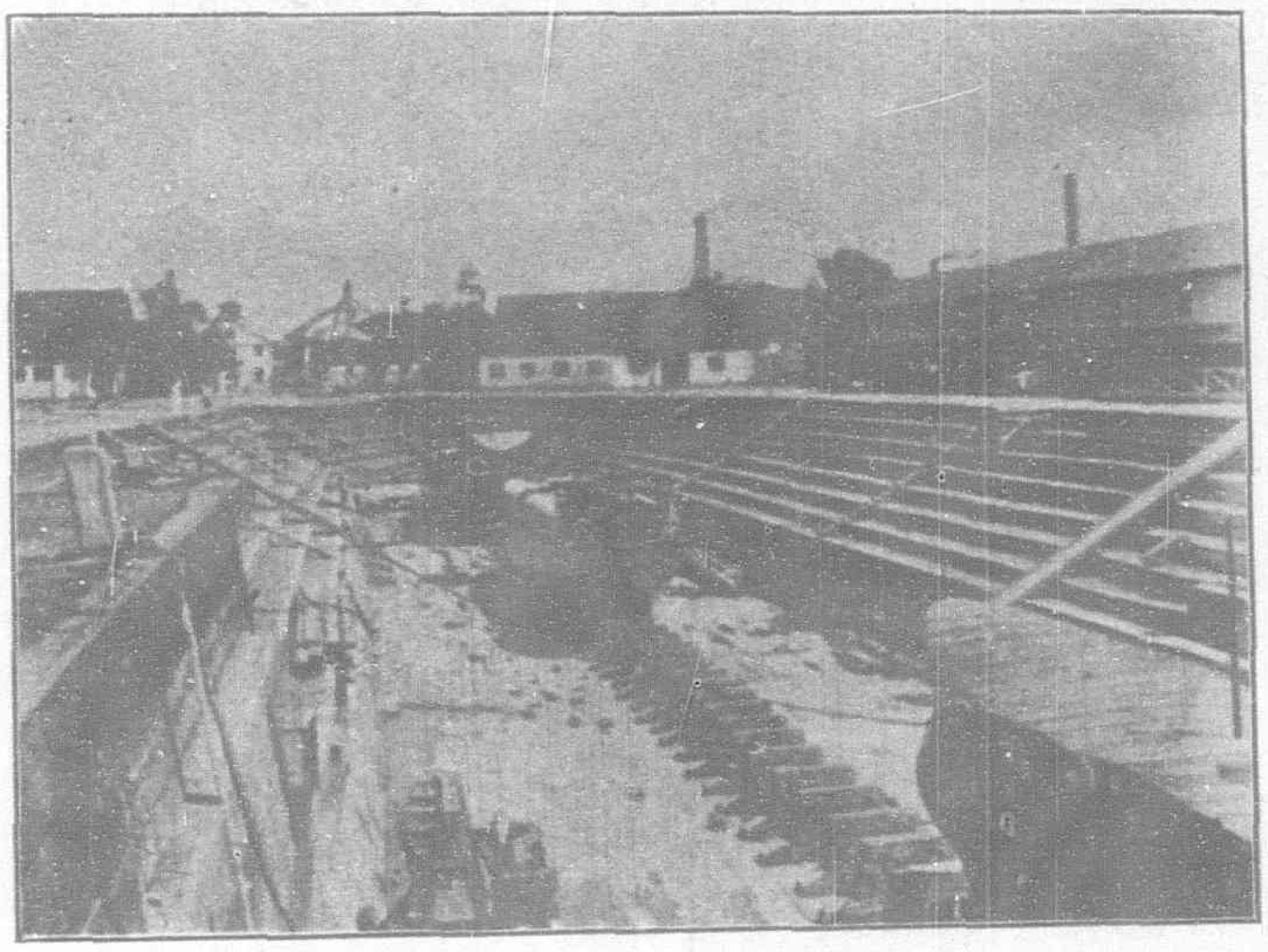
Estimates given for all classes of work; Coast Steamers, Side and Stern-Wheelers, Tugboats, Launches, Steam Barges, Dredgers, Floating Cranes, and Lighters a speciality.

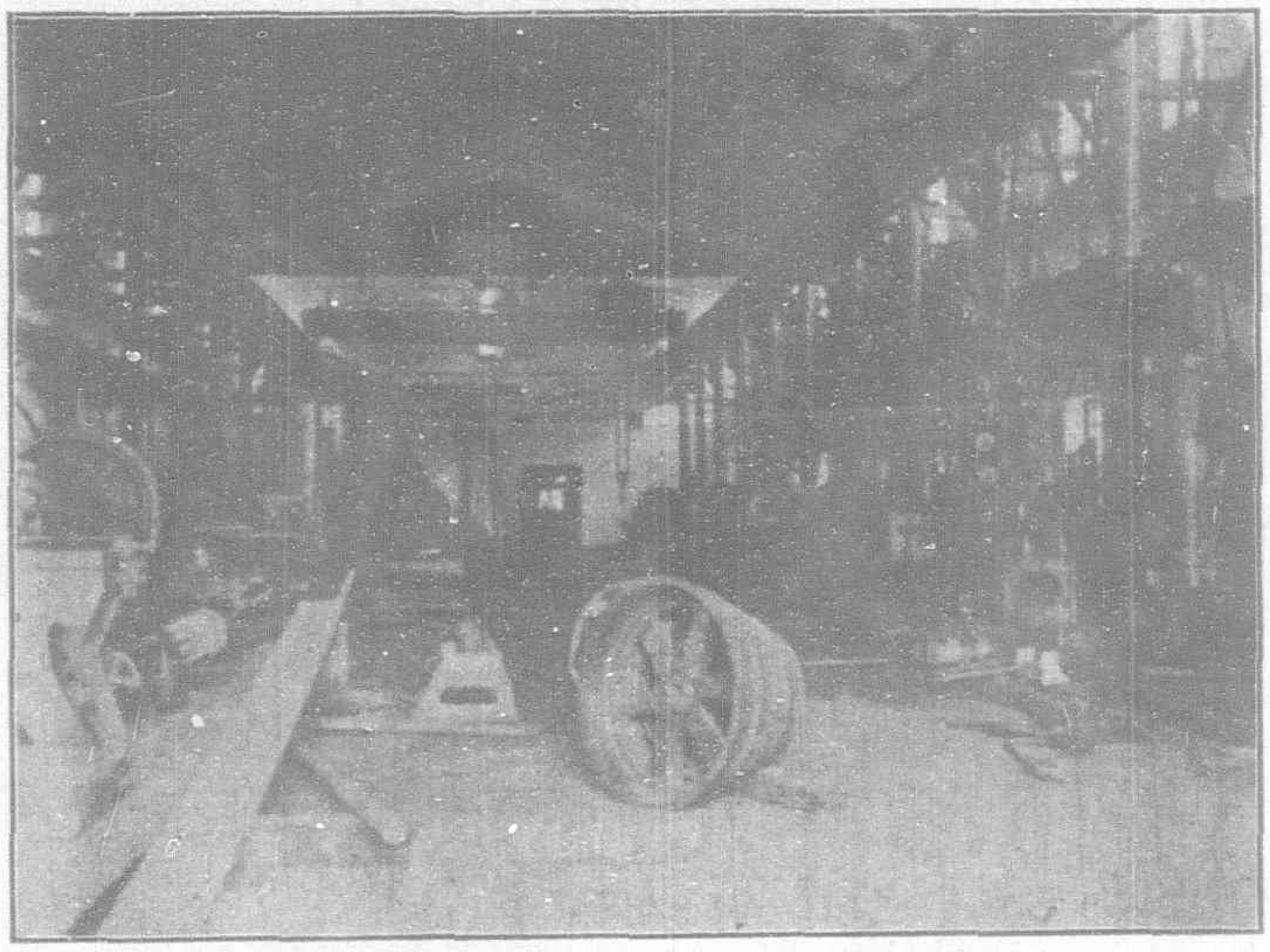
Every description of repairs and renewal work undertaken and expeditiously executed.

Land and Marine Engines and Boilers, Centrifugal, Mining, and other pumping machinery always in stock or in progress, also power-driven Machine Tools, Engineer's Hand Tools, Steam, Gas, Oil, and Electric machinery and engineering accessories generally.

CORRESPONDENSE INVITED

KIANGNAN
DOCK AND ENGINEERING
WORKS





KIANGNAN DOCK—Length over all, 385′; length on blocks, 375′; water on sill, 19′; dock entrance, top, 70′, bottom, 60′.

The dock accommodates the largest coasting steamers and is equipped with complete modern facilities for handling work thoroughly and promptly.

The new machine and boiler shops, and the foundry and shipbuilding plant are equal to any this side of Suez.

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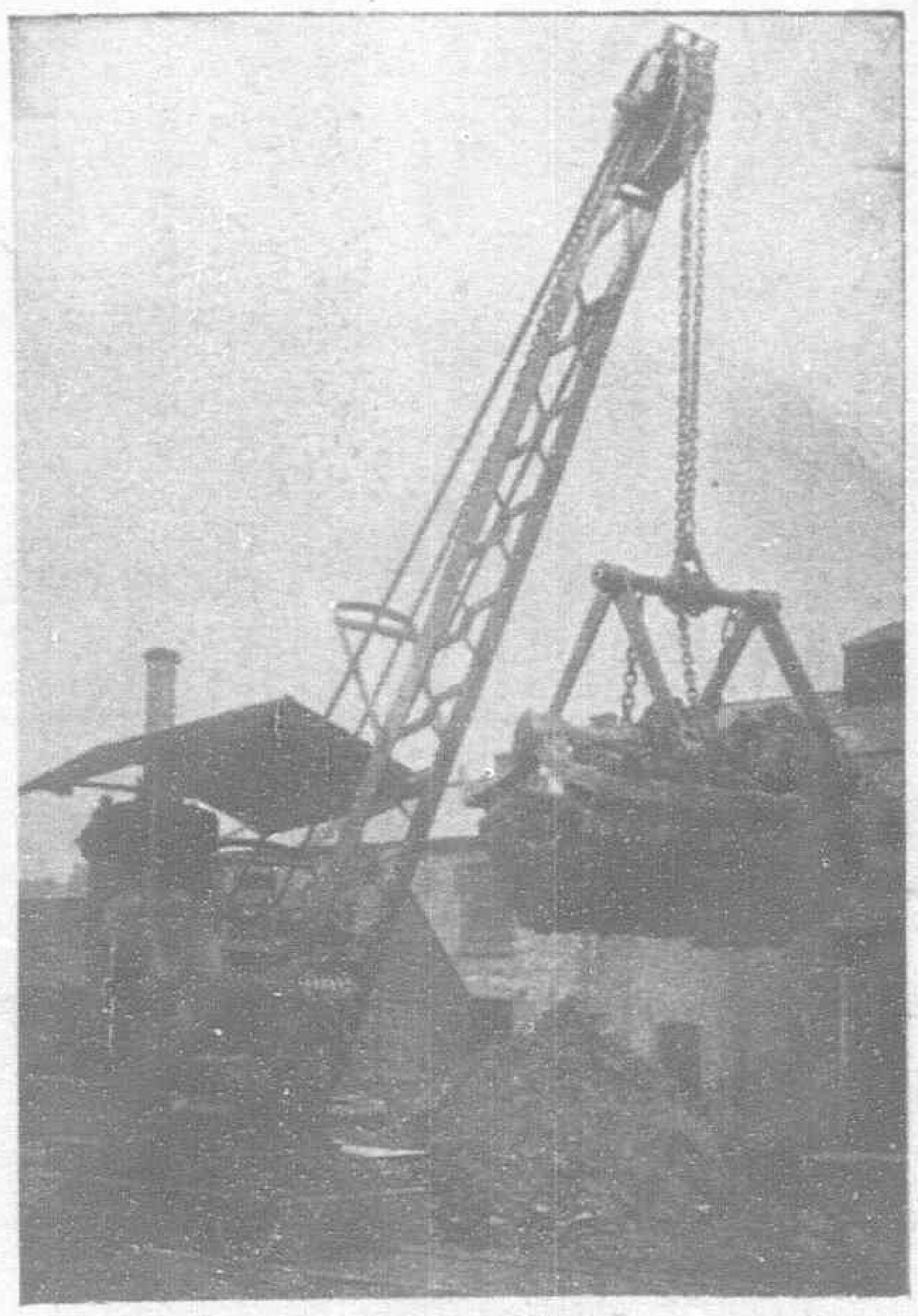

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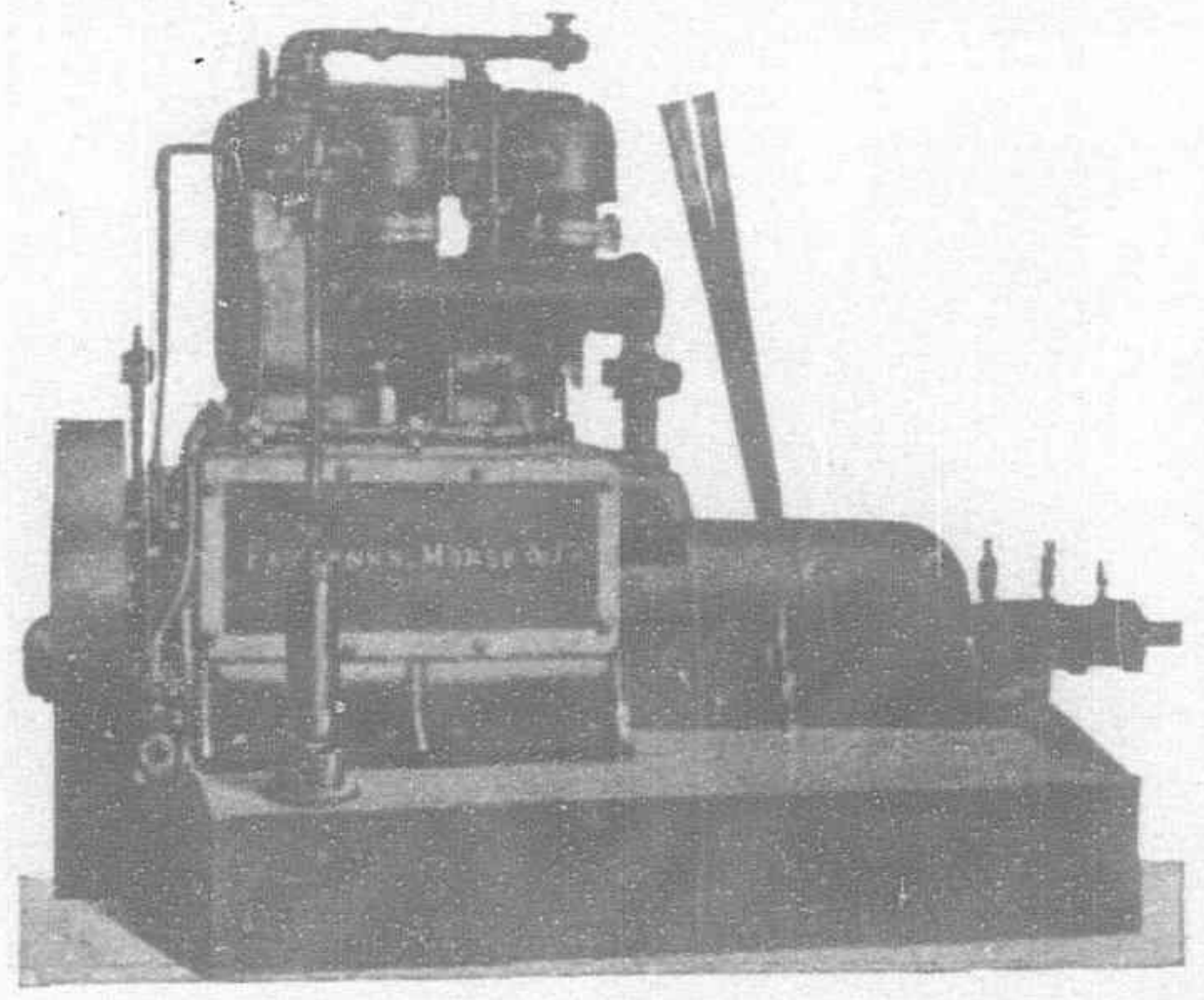
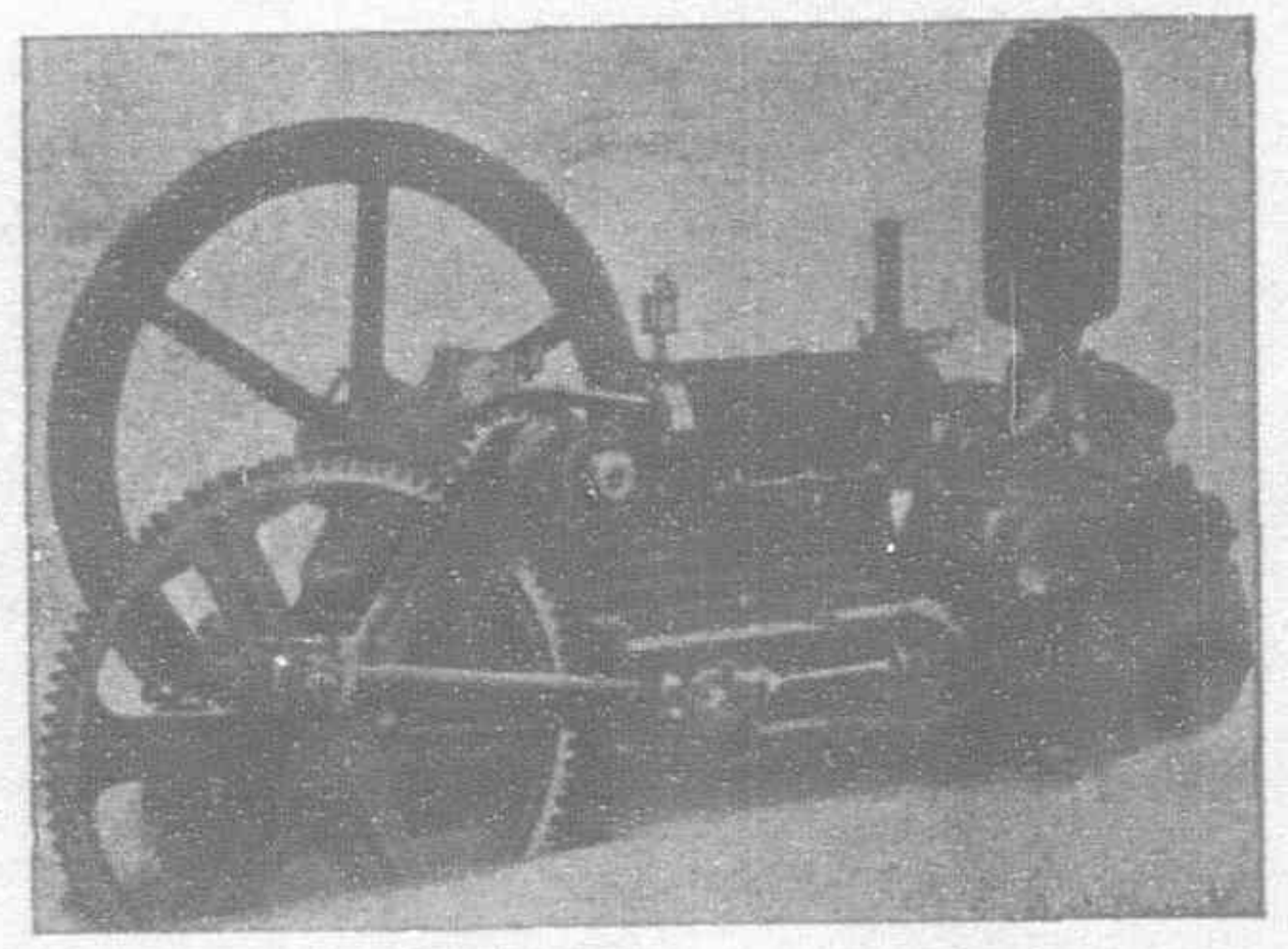
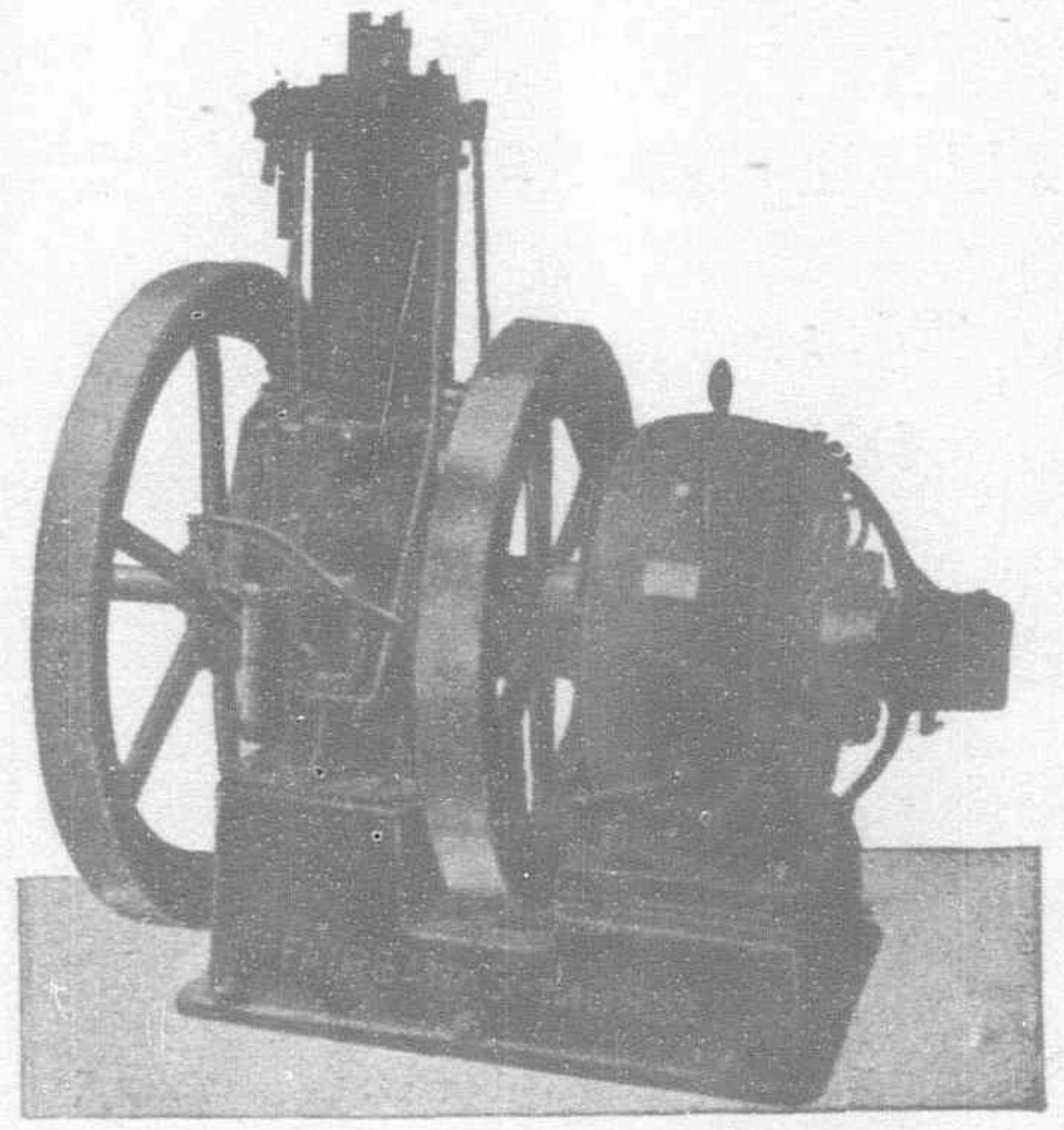

MARINE


GAS ENGINE AND PUMP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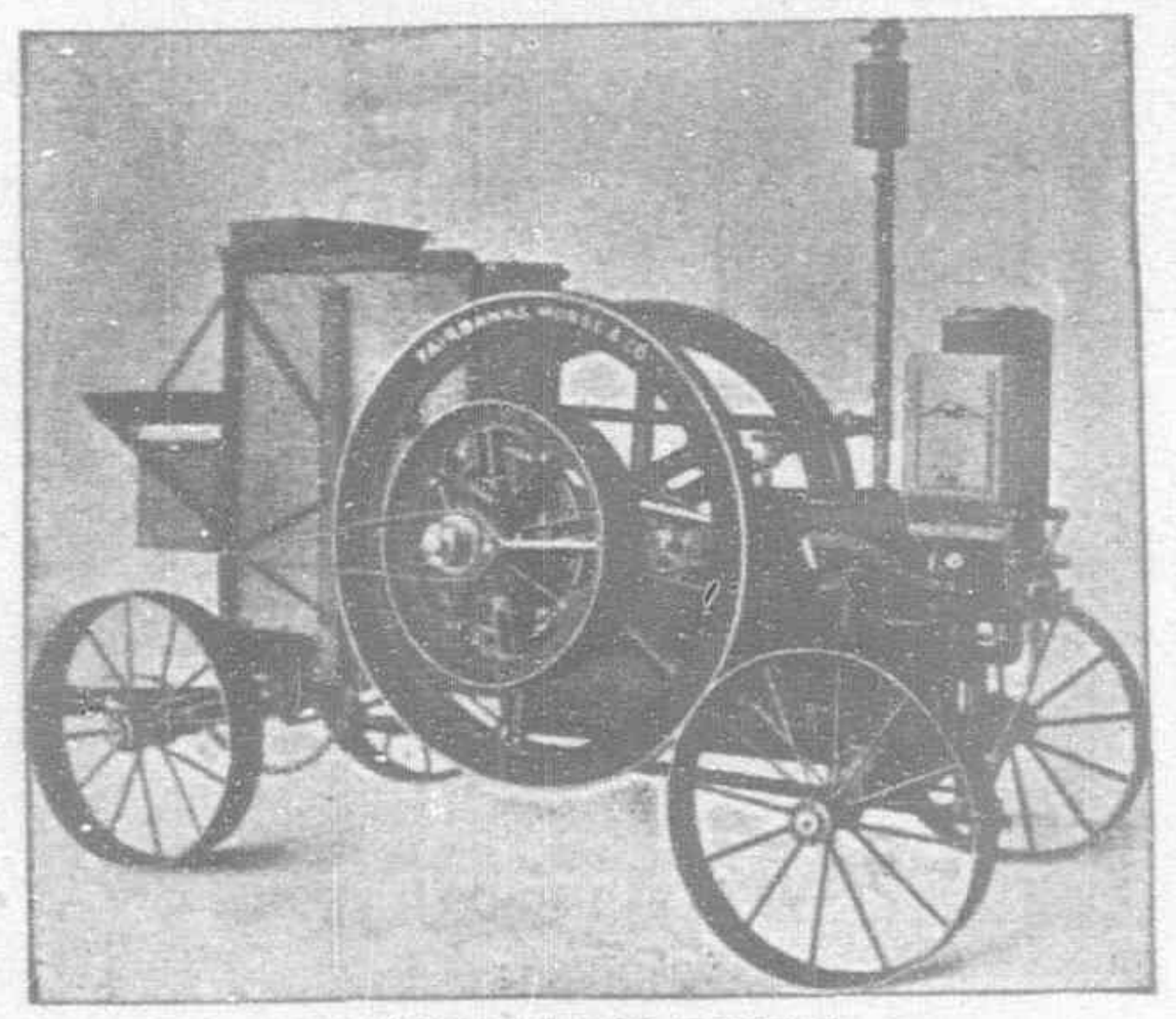
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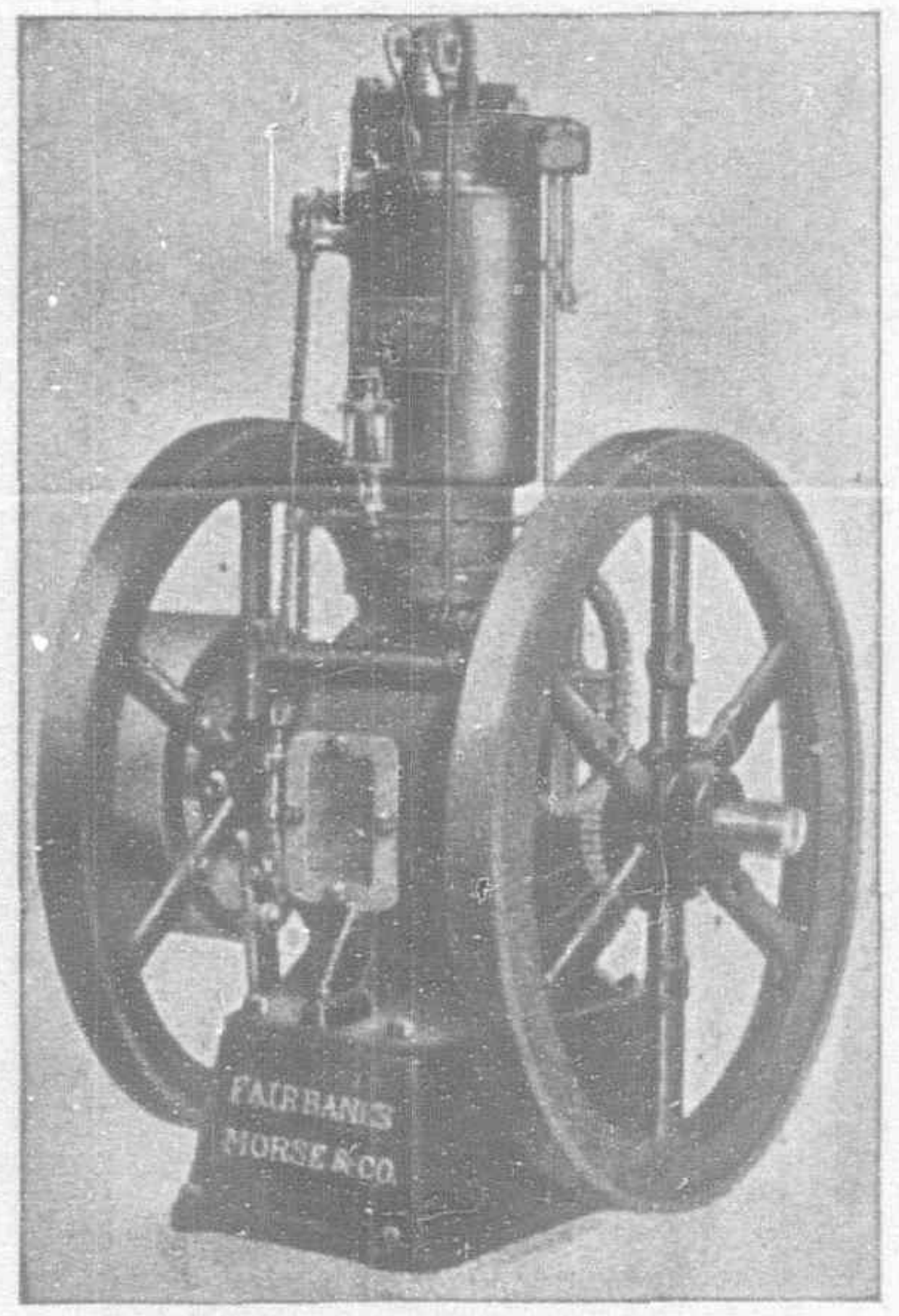
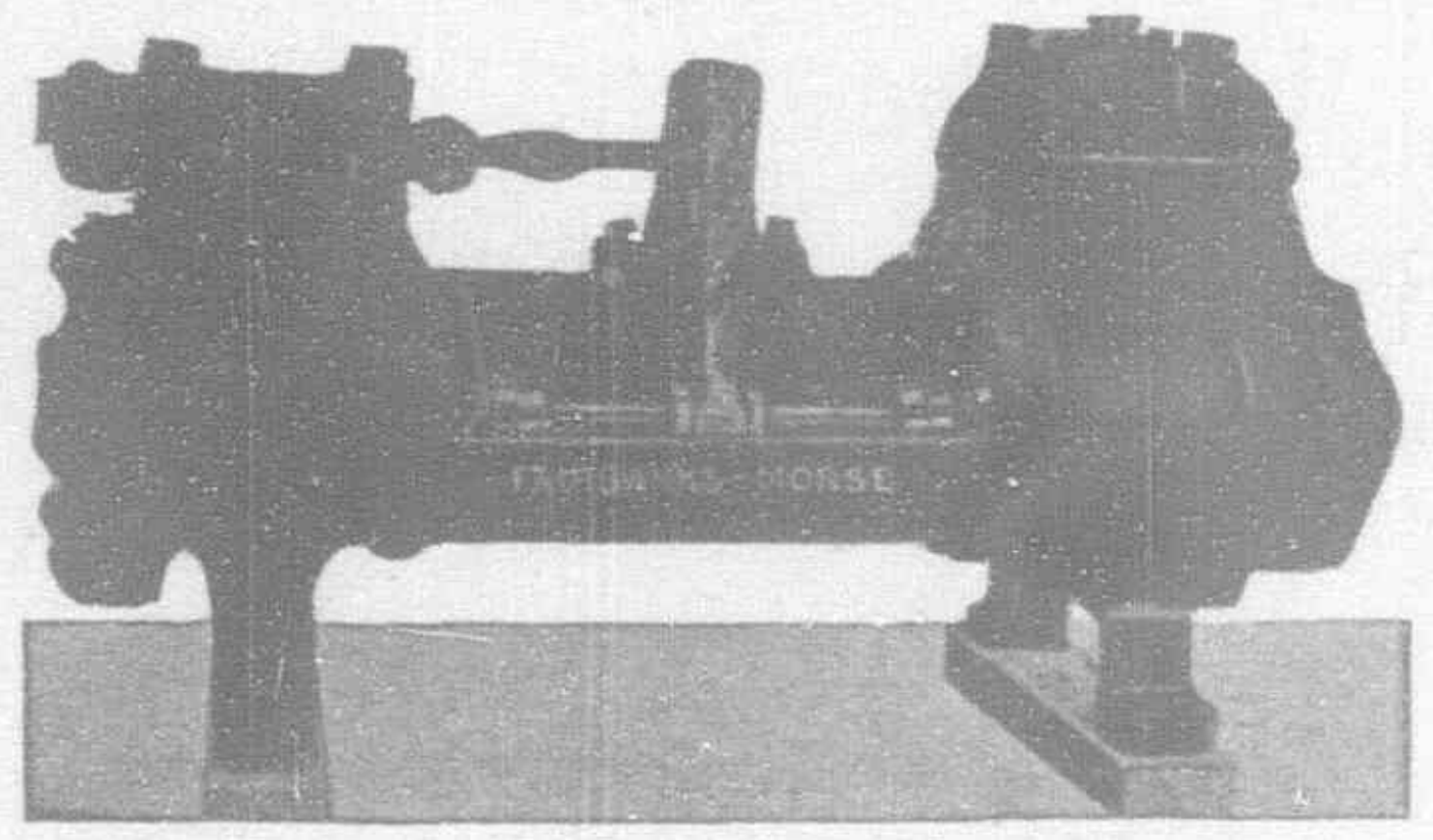

VERTICAL ENGINE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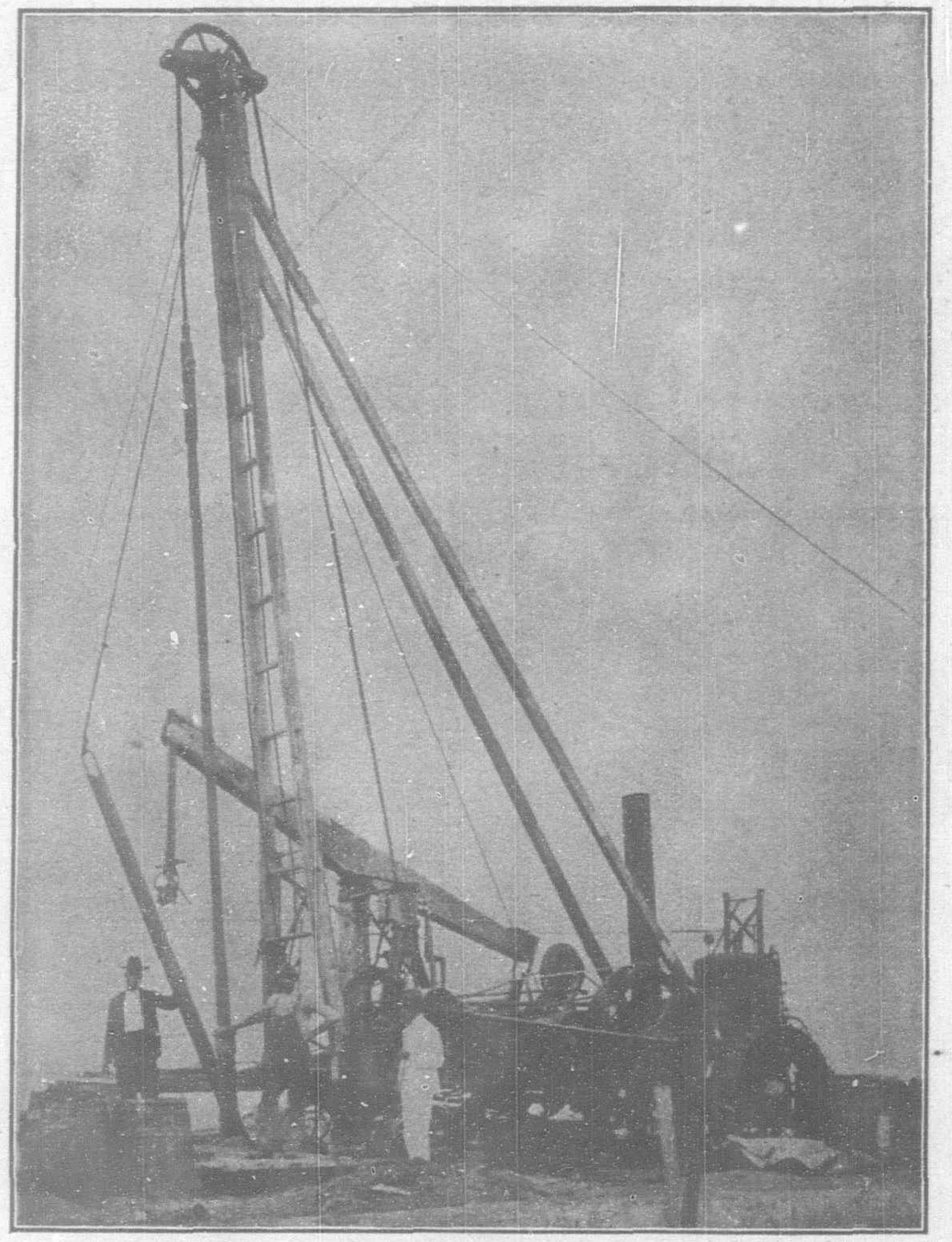

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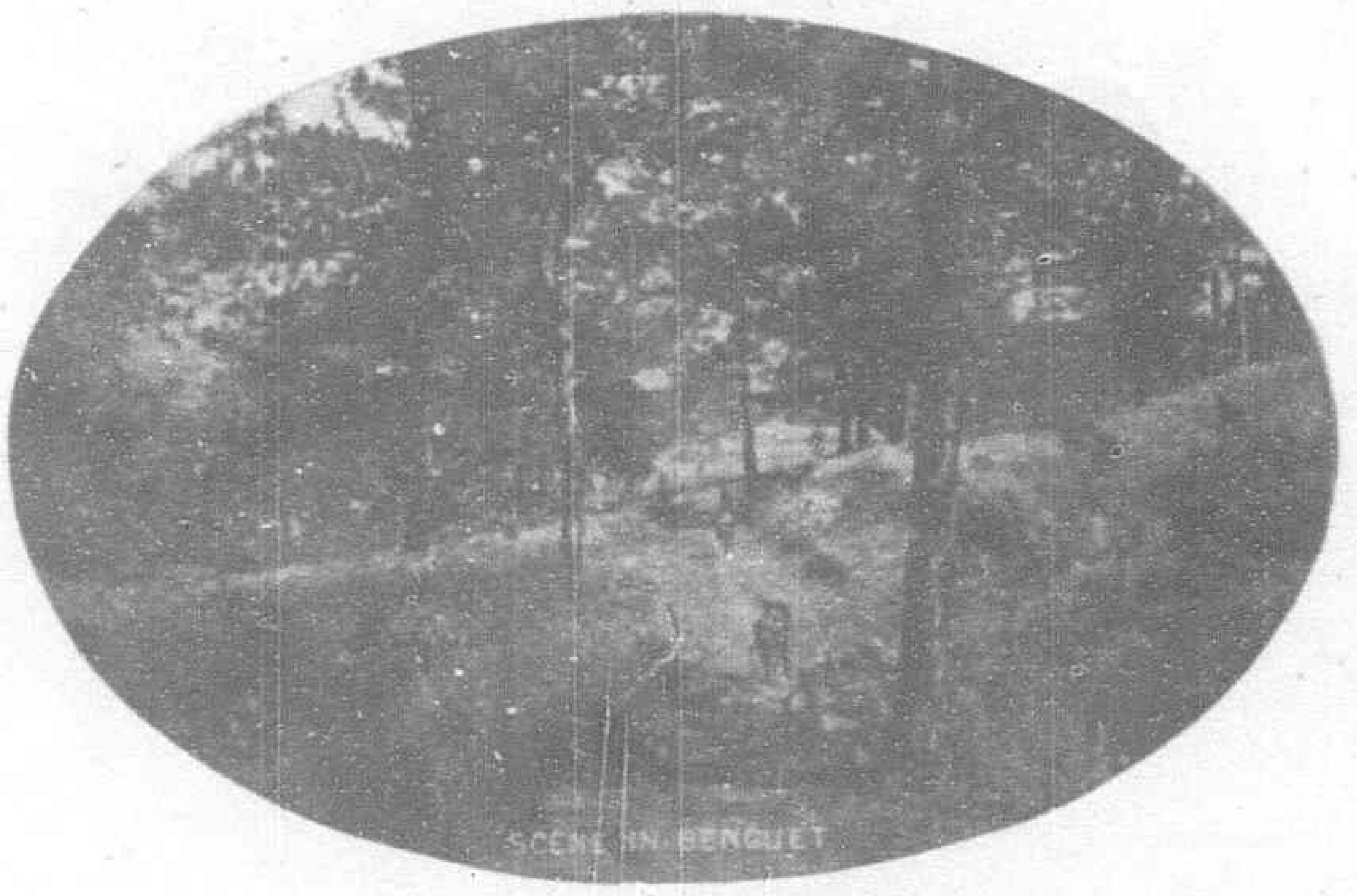

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	P. M.	P. M.		P. M.	P. M.
Manila .... Dept.	2.40	10.00	Dagupan .... Dept.	2.55	10.00
S. Fernando .... "	4.37	11 52	Tarlac .... "	4.59	12 23
Bamban .... "	5.23	12.44	Bamban .... "	5.37	1.06
Tarlac .... "	6.15	1.41	S. Fernando .... "	6.24	2.02
Dagupan .... Arr.	8 29	A. M. 3.50	Manila .... Arr.	8.10	A. M. 3.50
	On Saturdays only	On Thursdays only		On Fridays only	On Sundays only

These trains will stop only at the Stations named.

The accommodation on these trains will be limited to one parlor Car, 1. first Class Car new type and one second class Car for servants. The Cars are of modern design and are furnished with electric light throughout.

Servants will not be allowed to occupy the first class accommodation and must only enter the cars when necessary to attend the wants of their employers.

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Fare: First class tickets only will be issued at one and a half ordinary rate.

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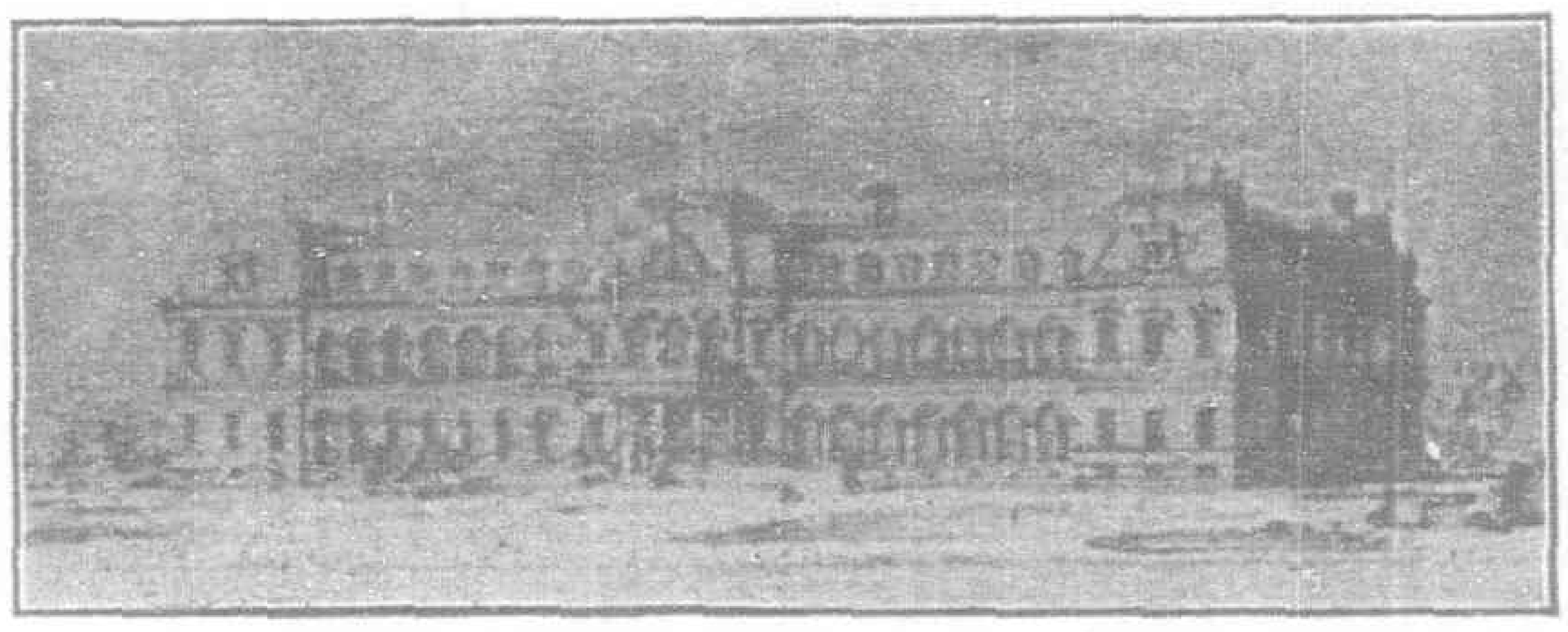

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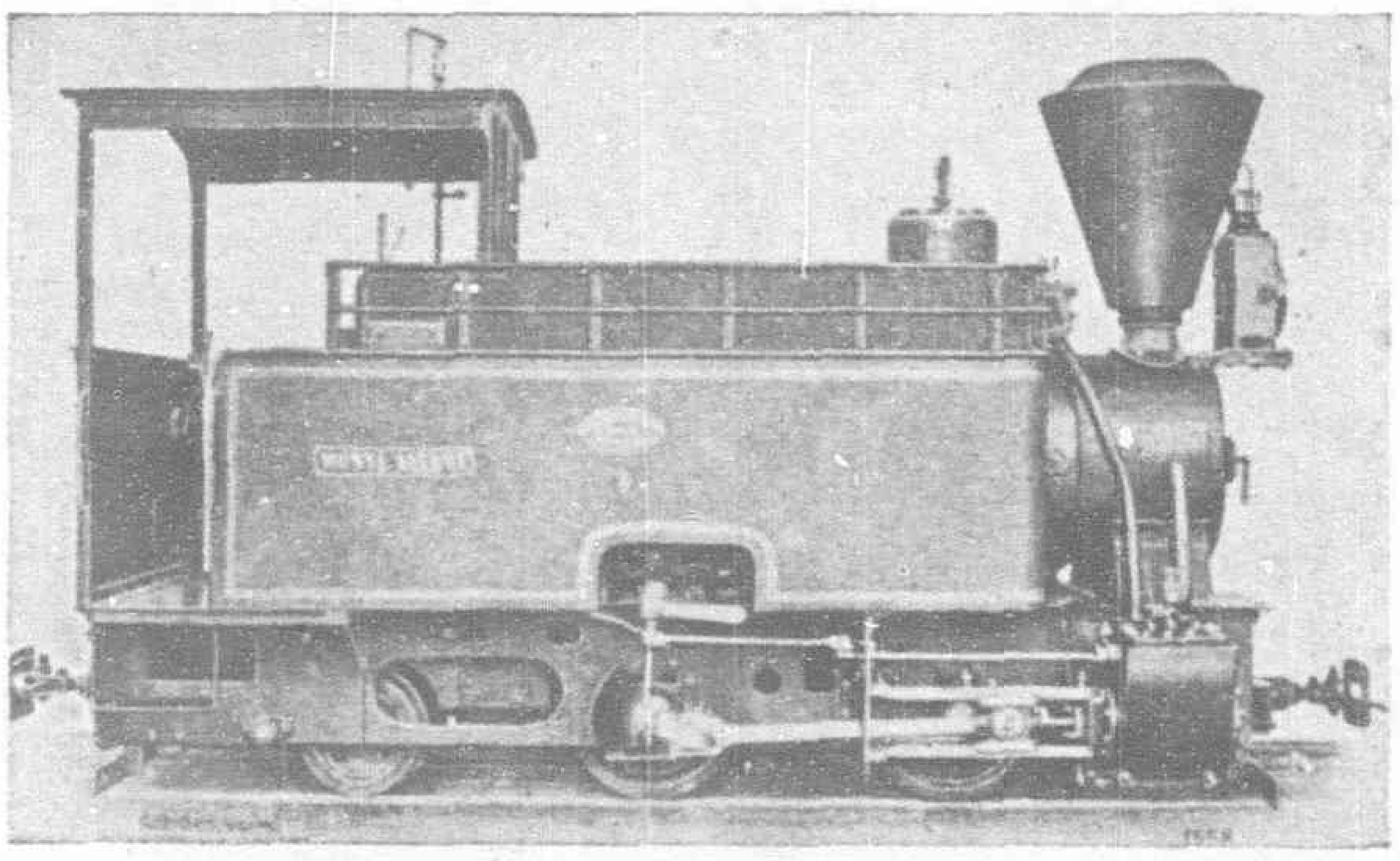

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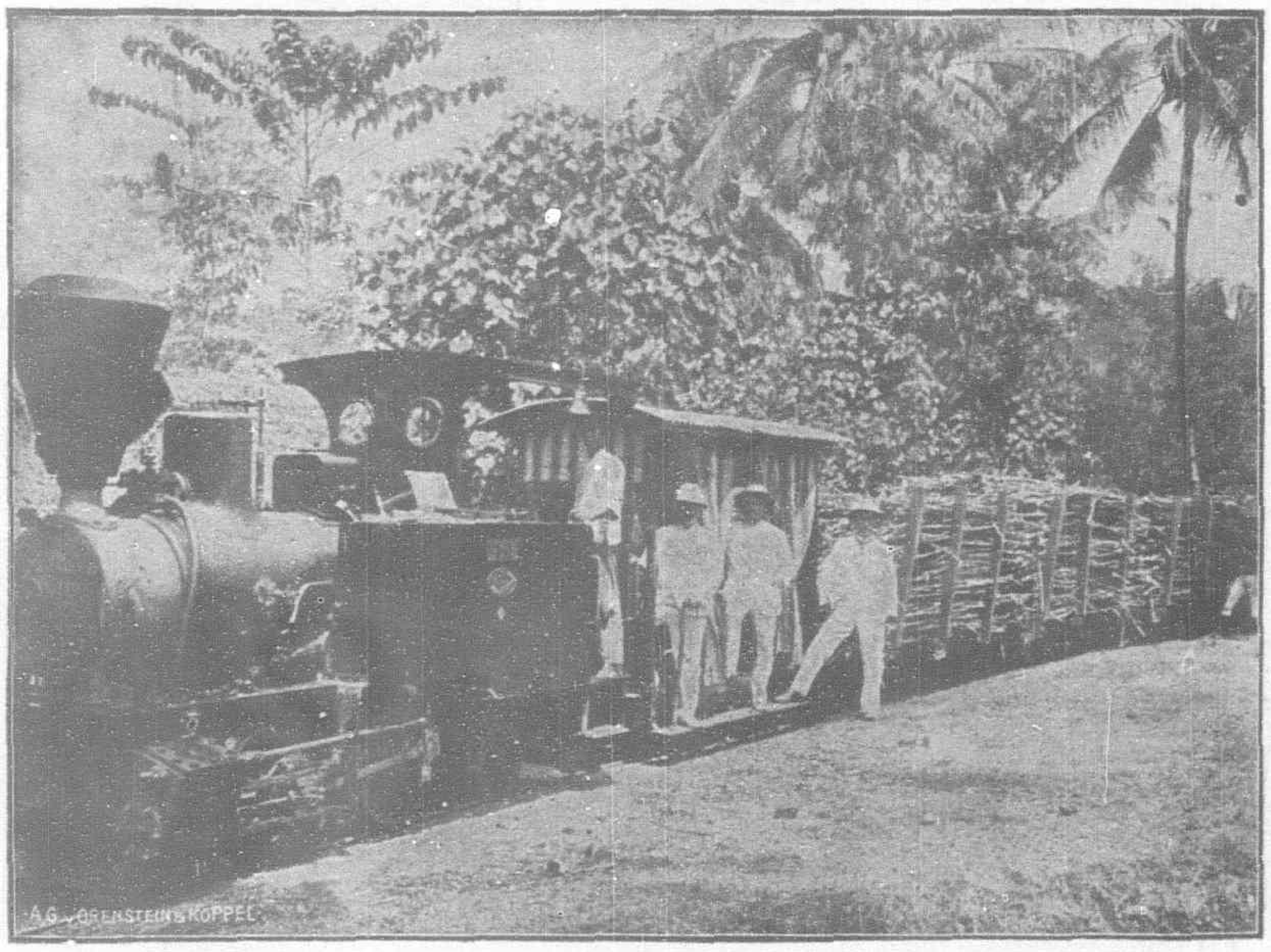

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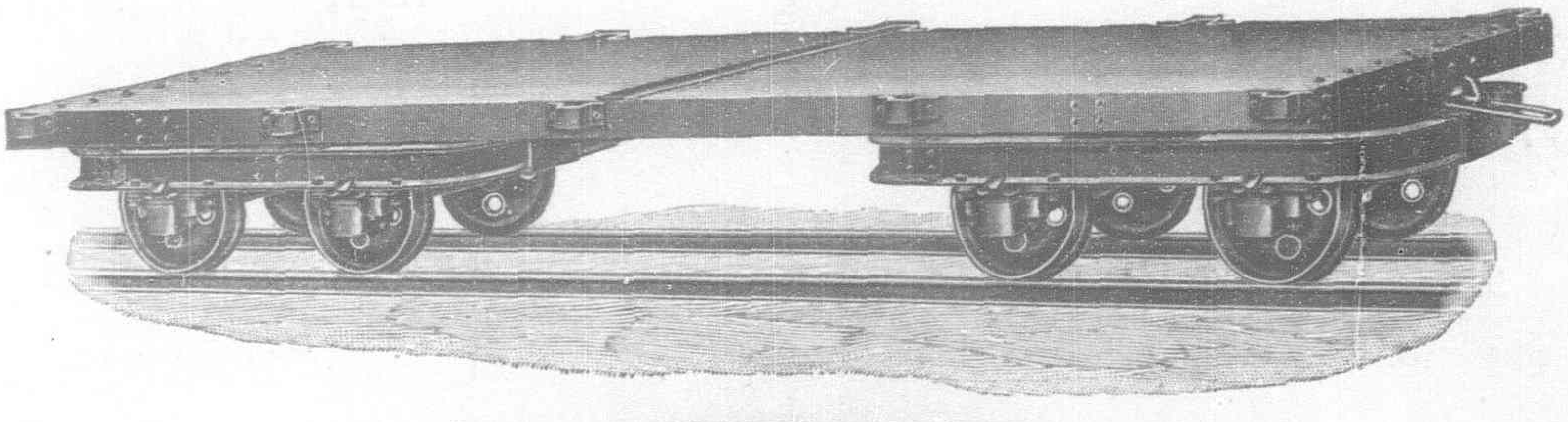

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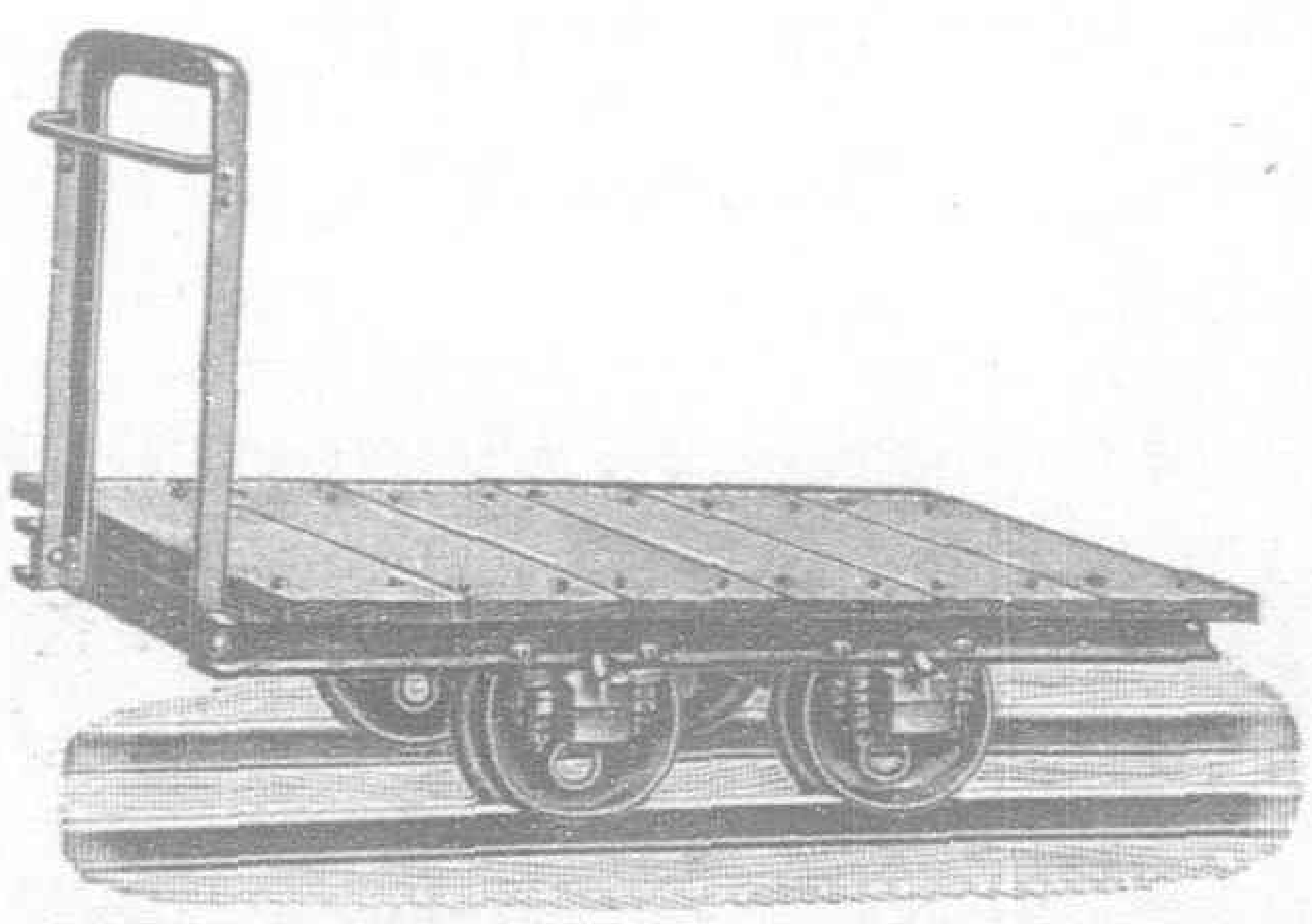

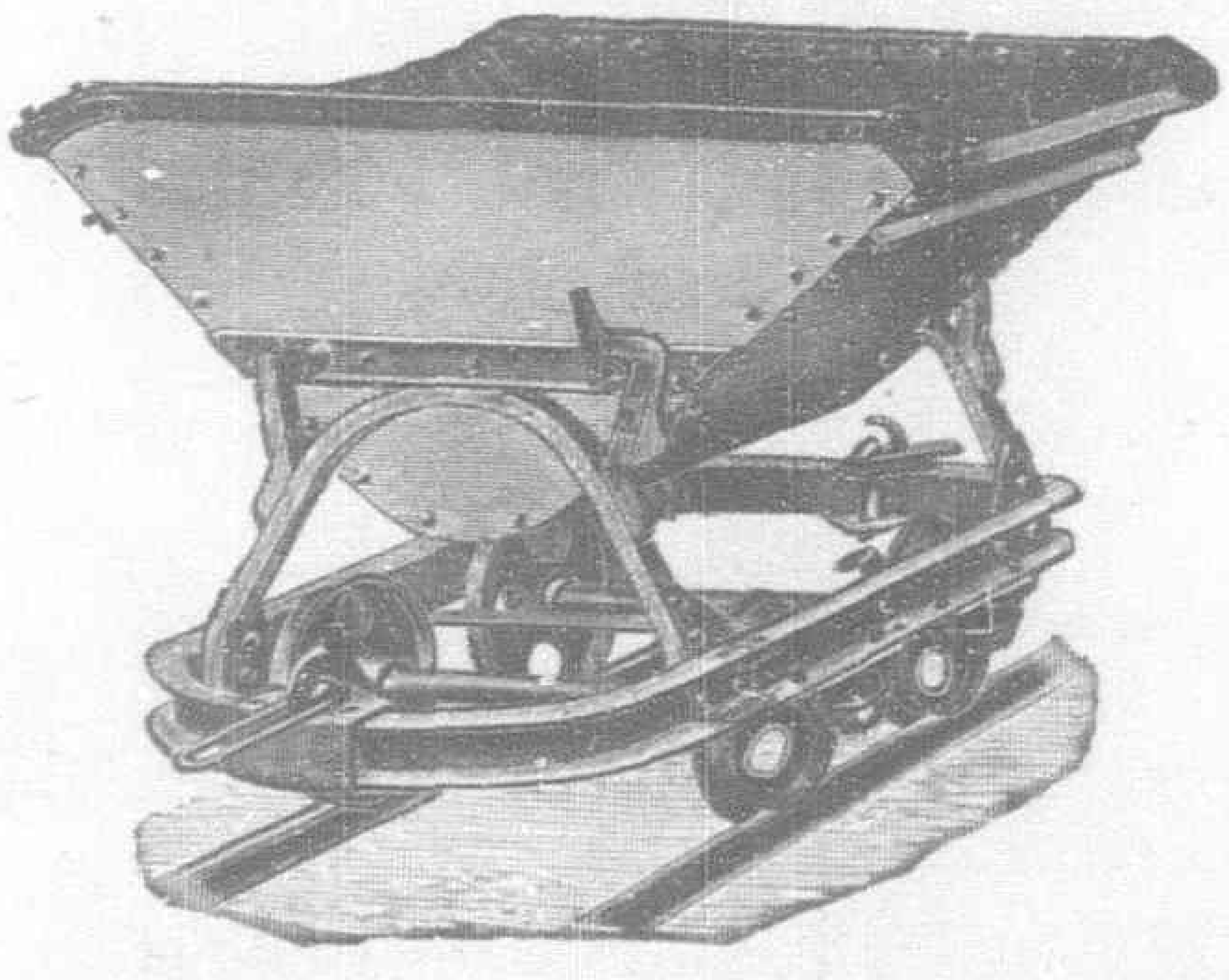

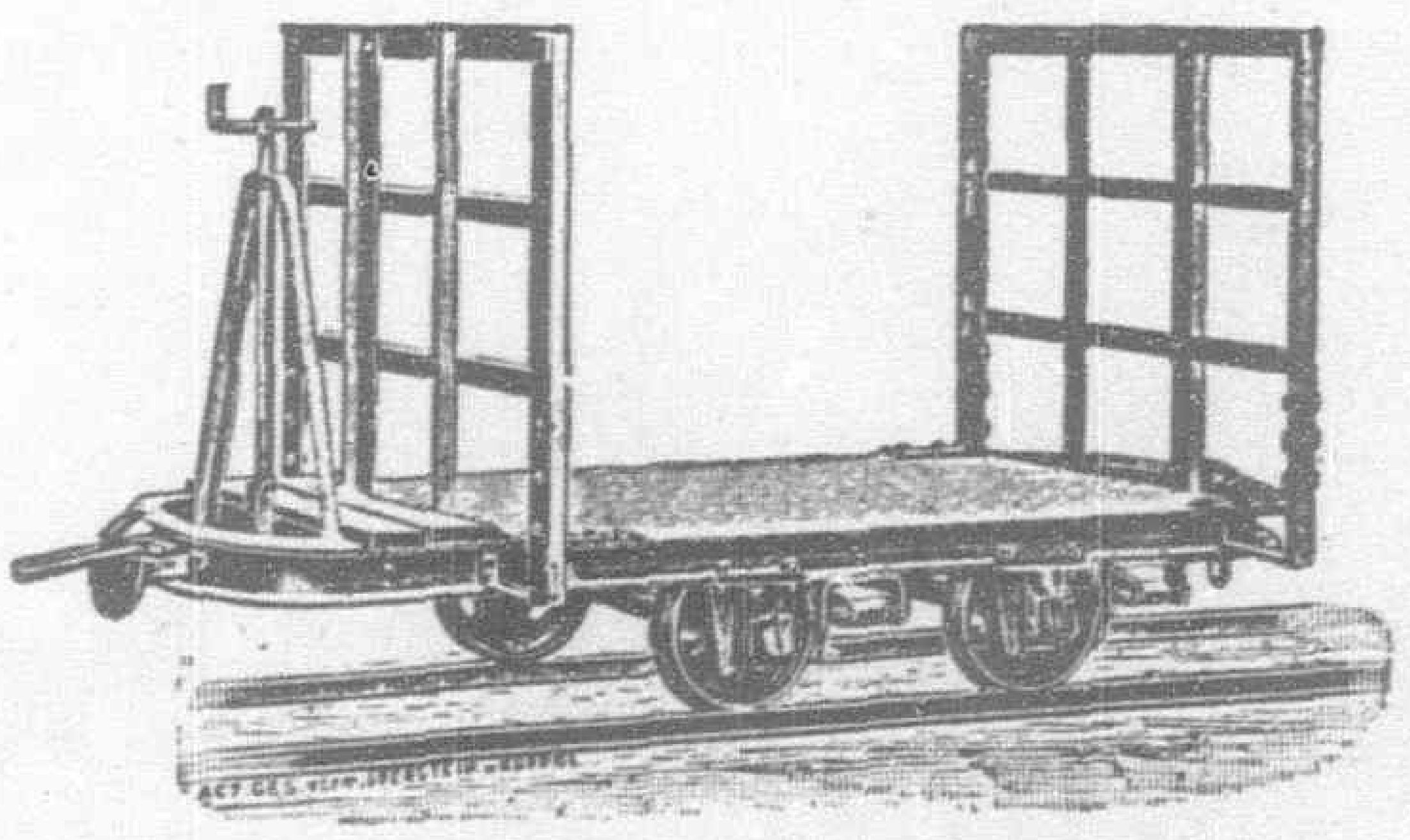

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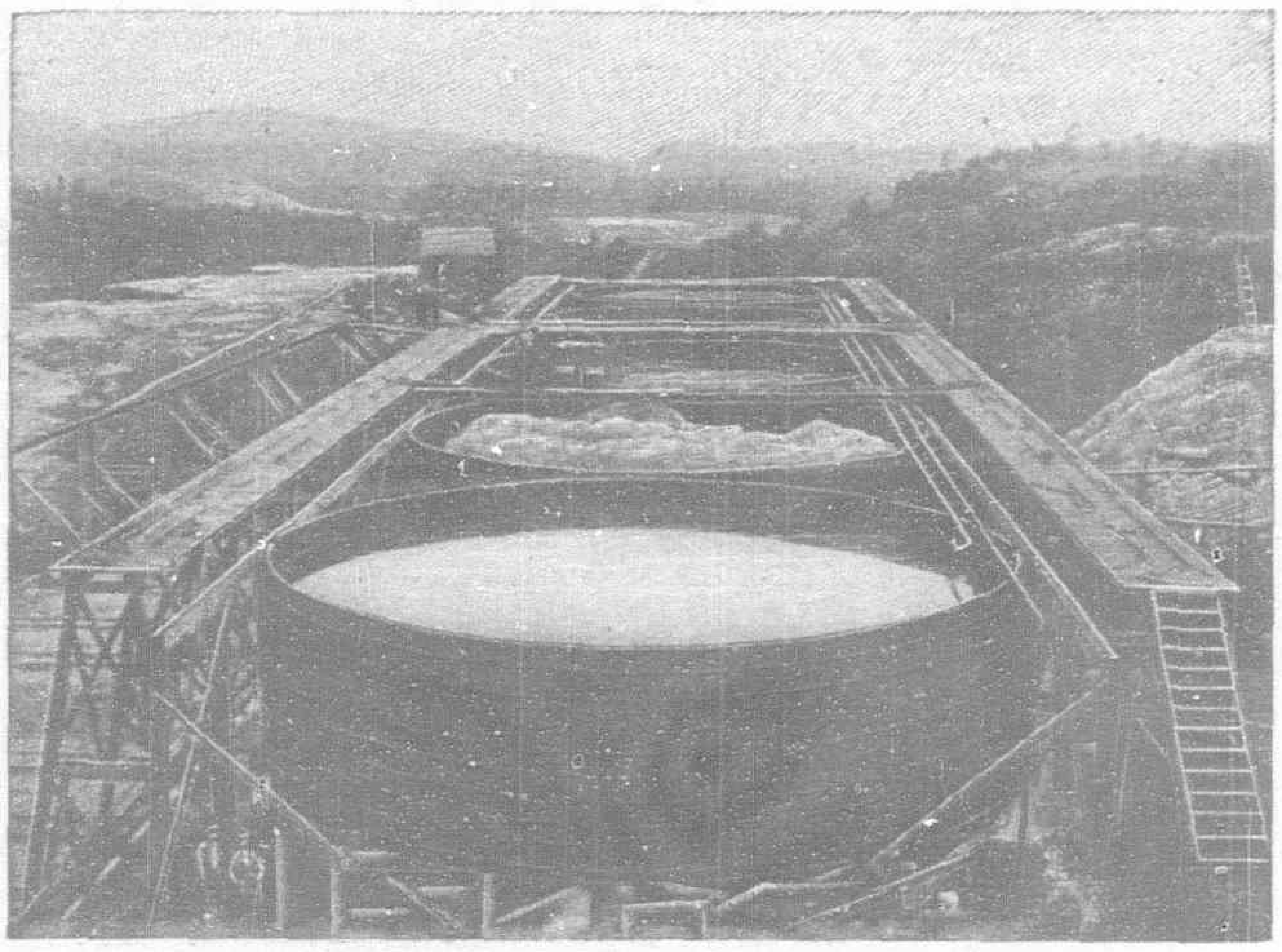

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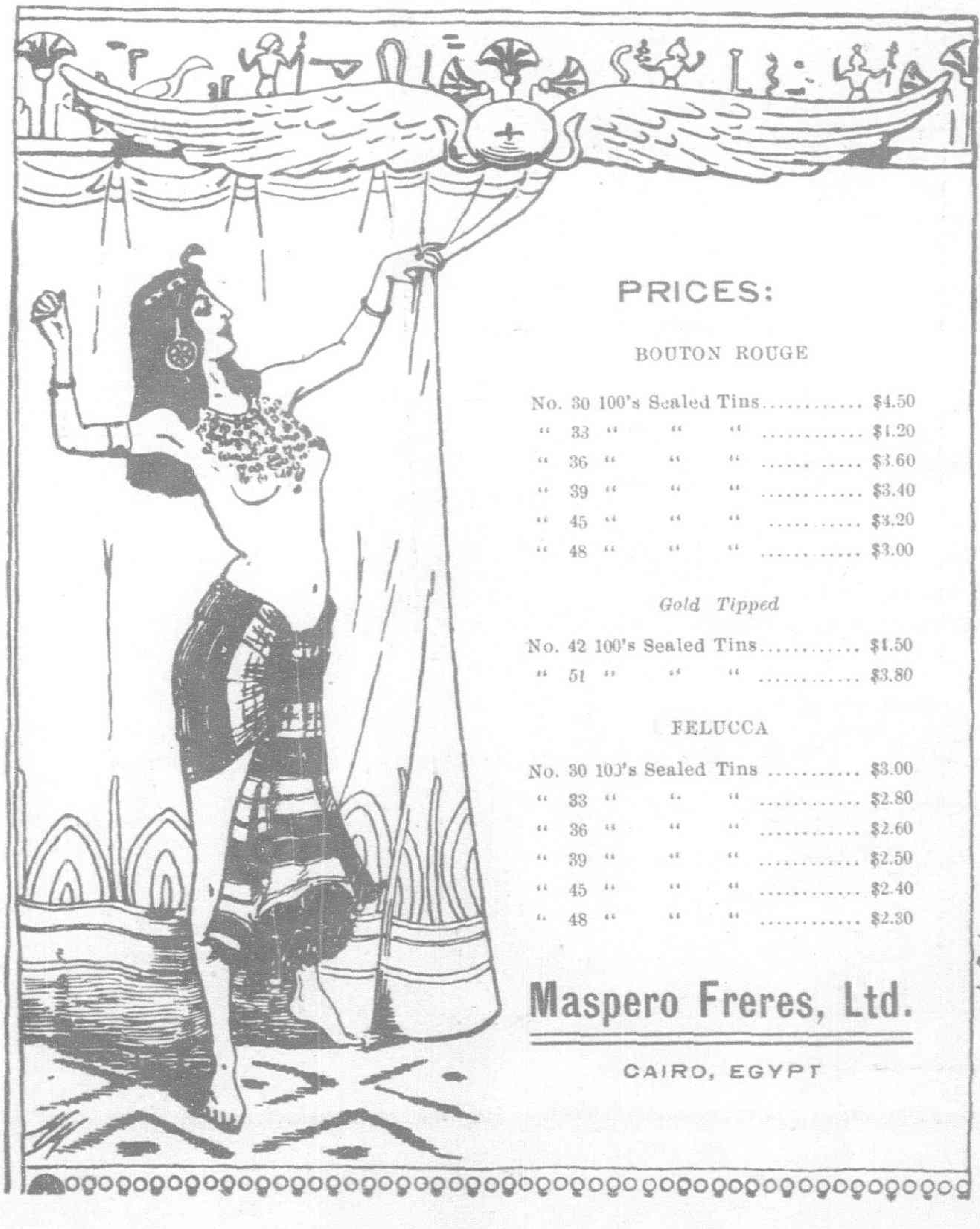

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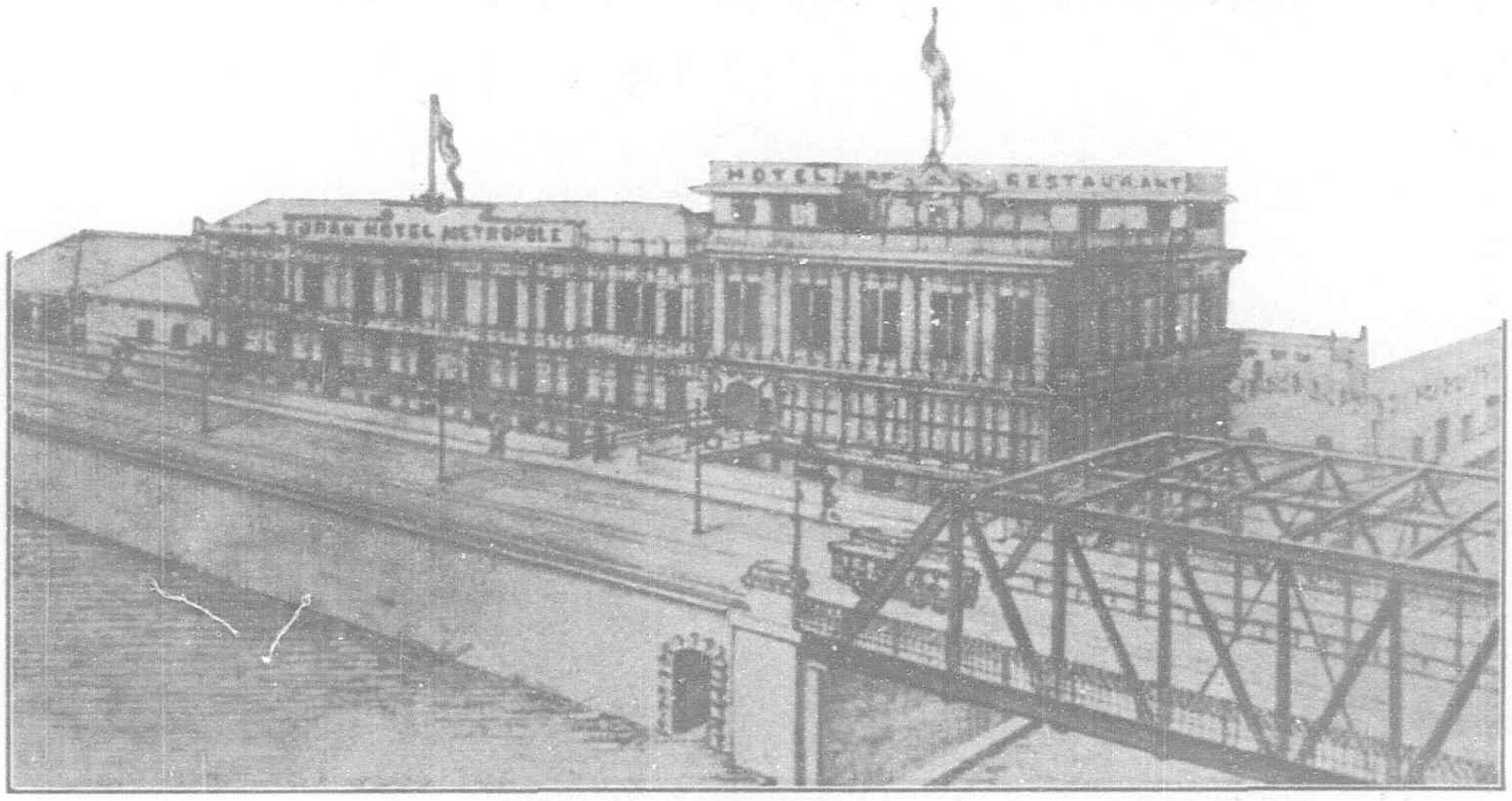

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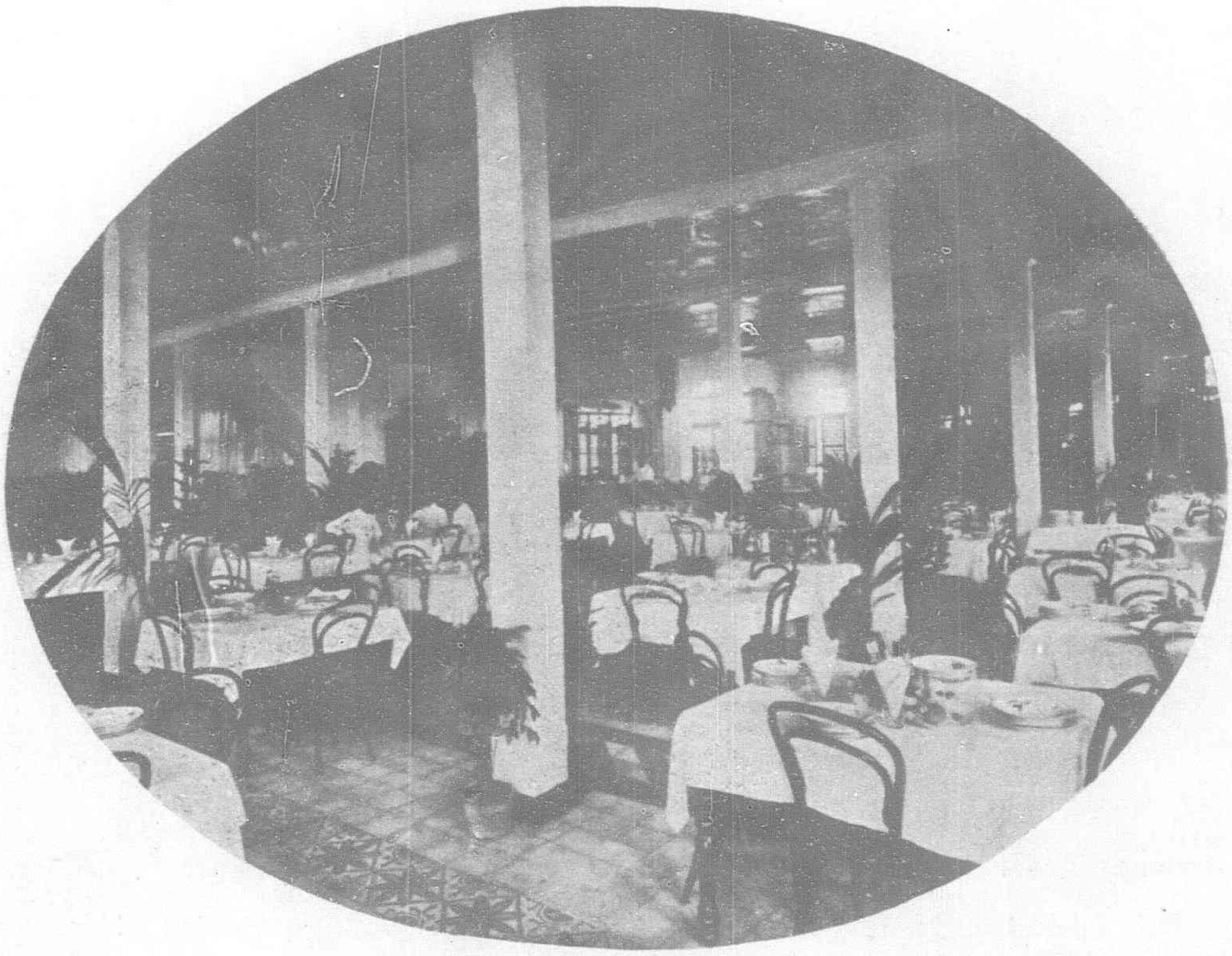

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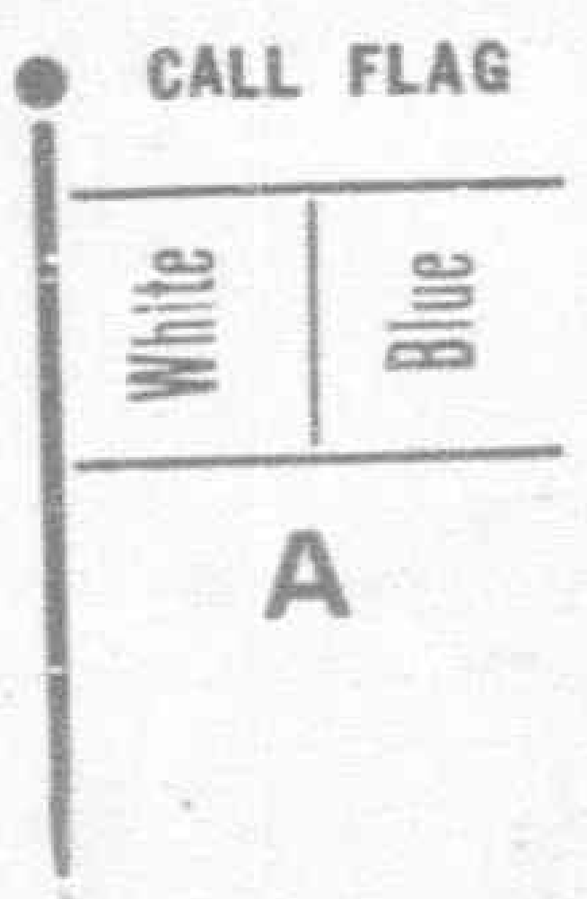

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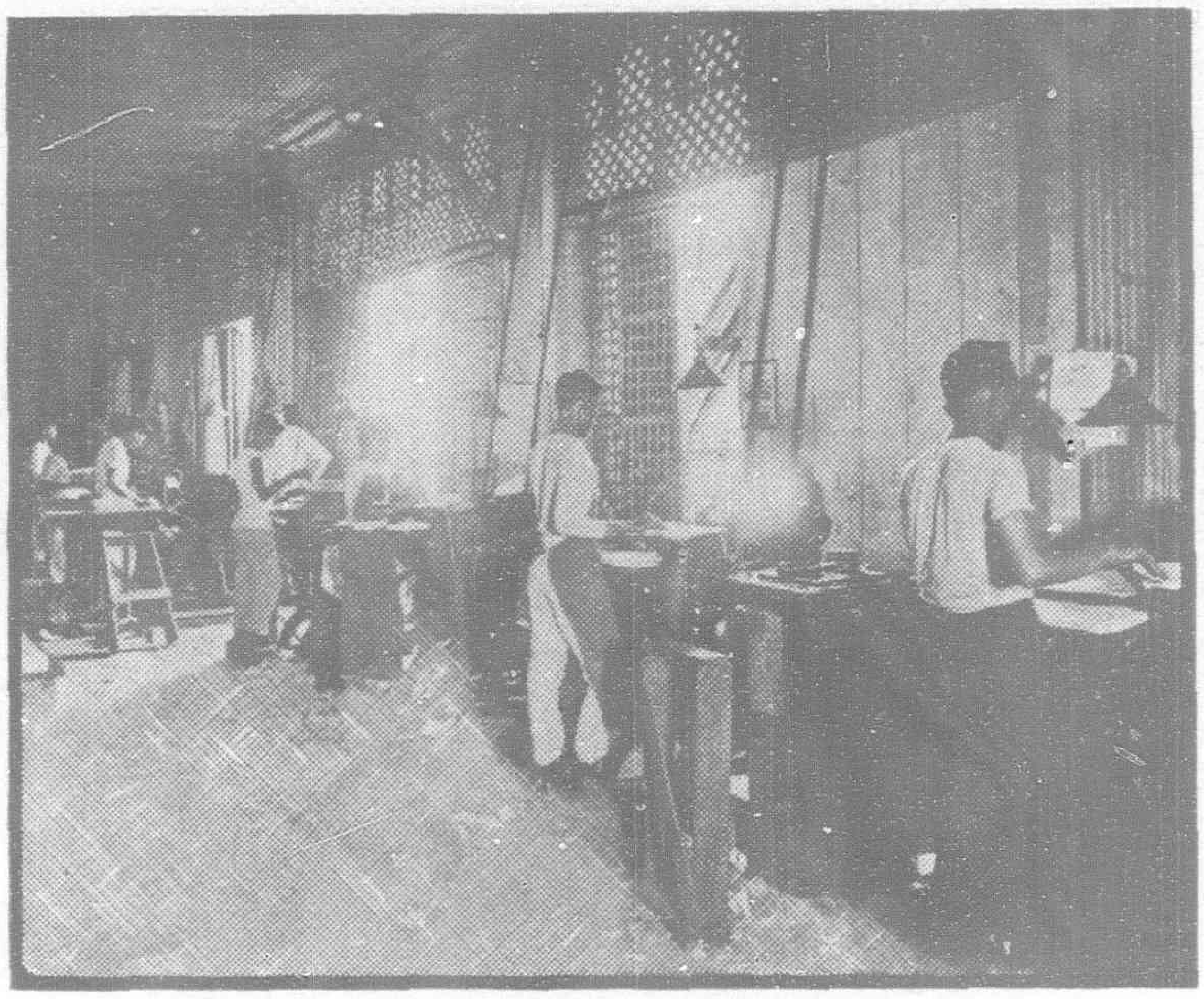

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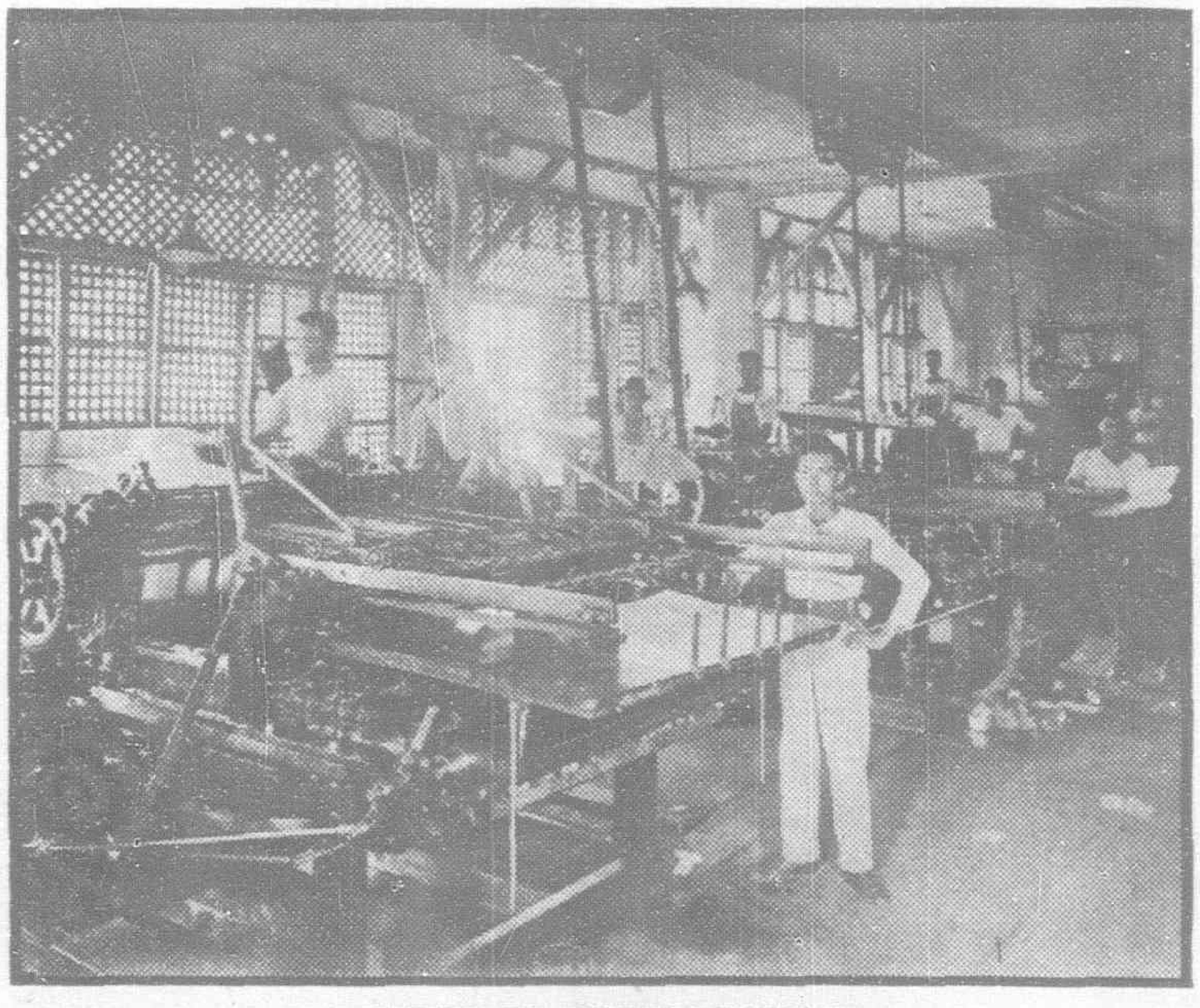

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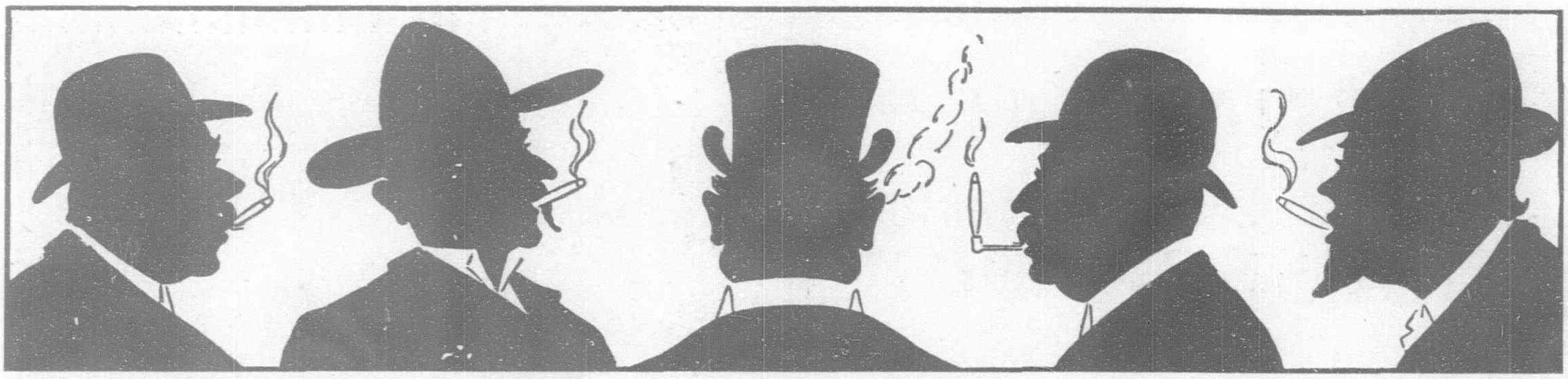

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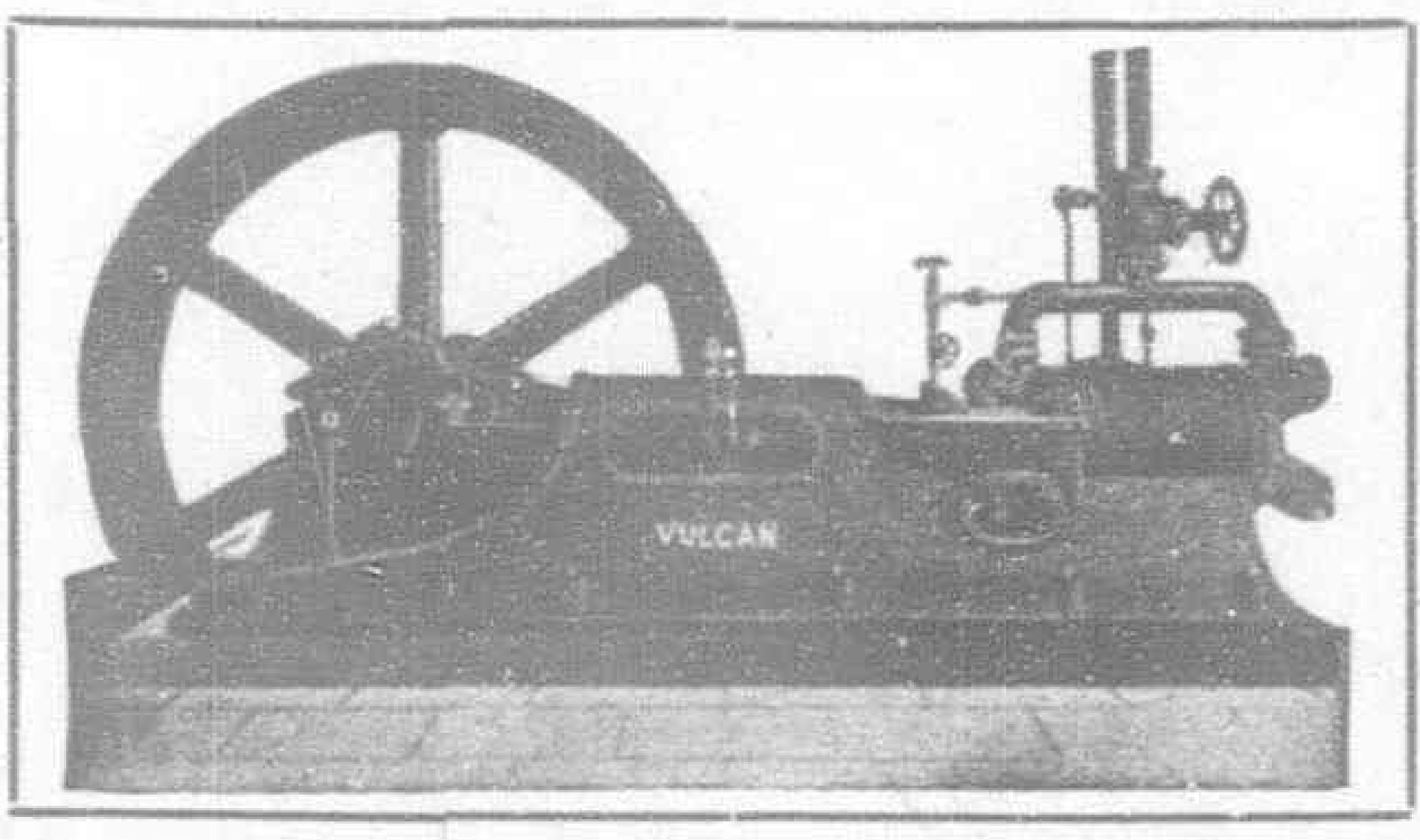

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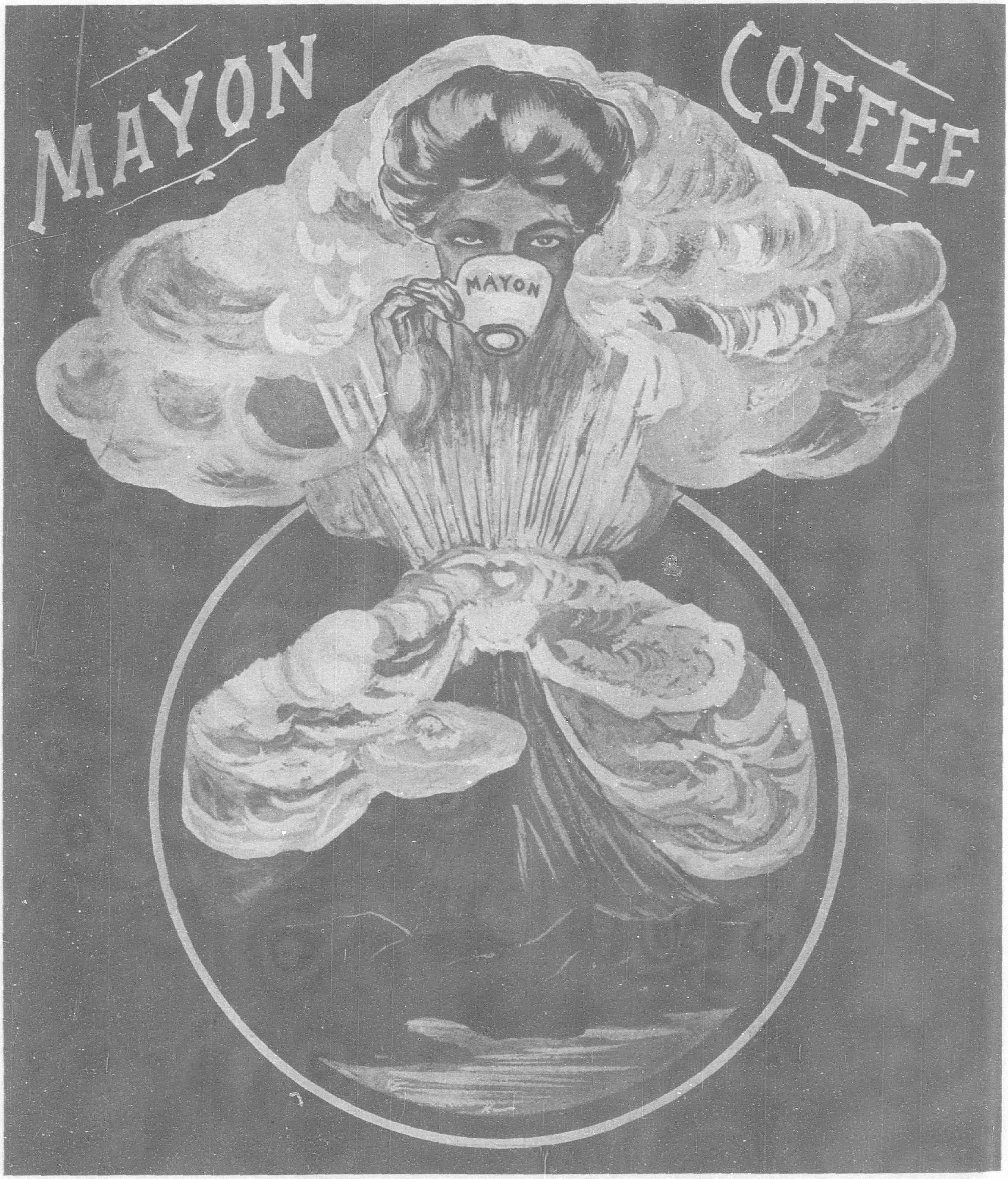

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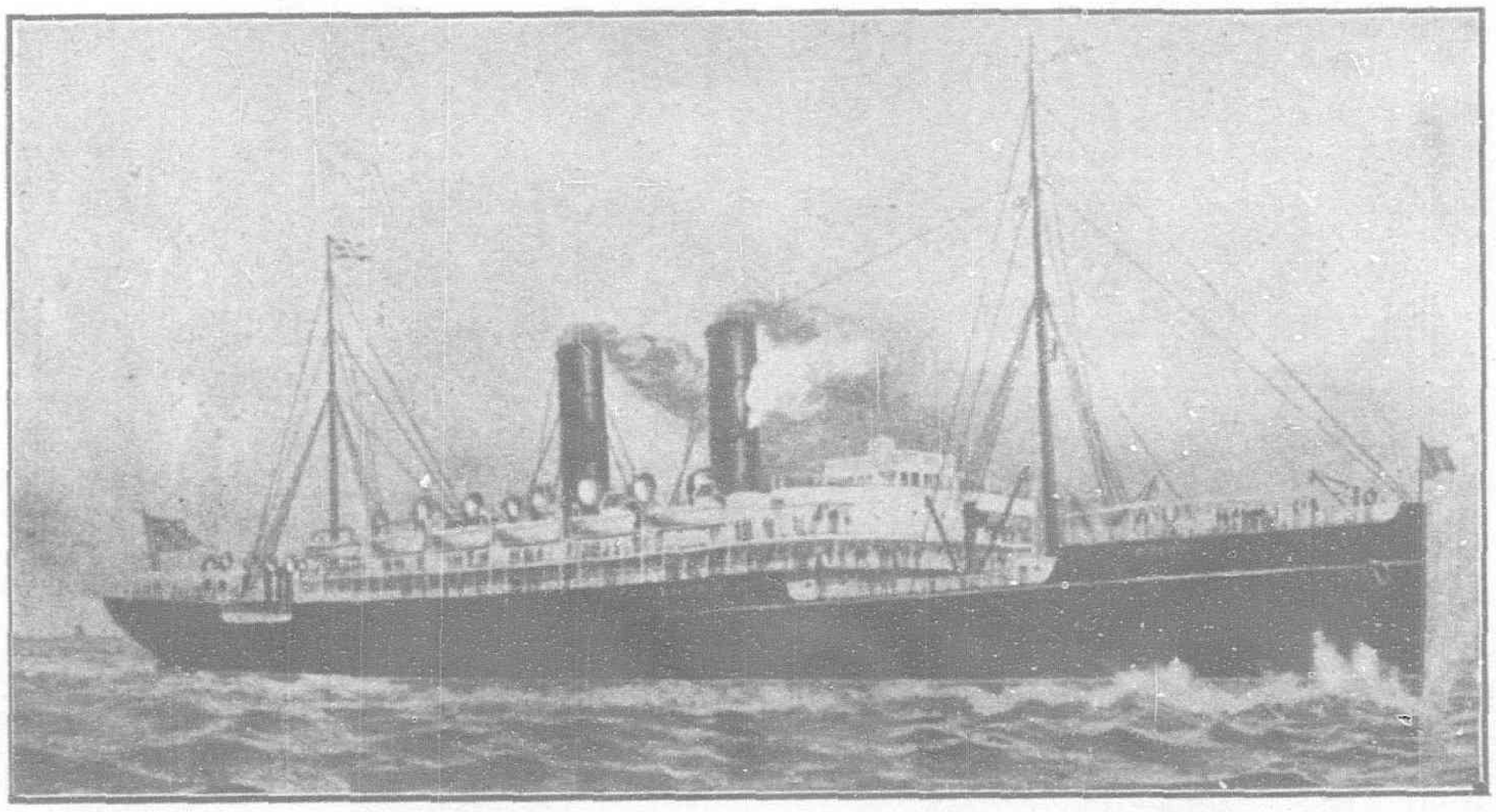

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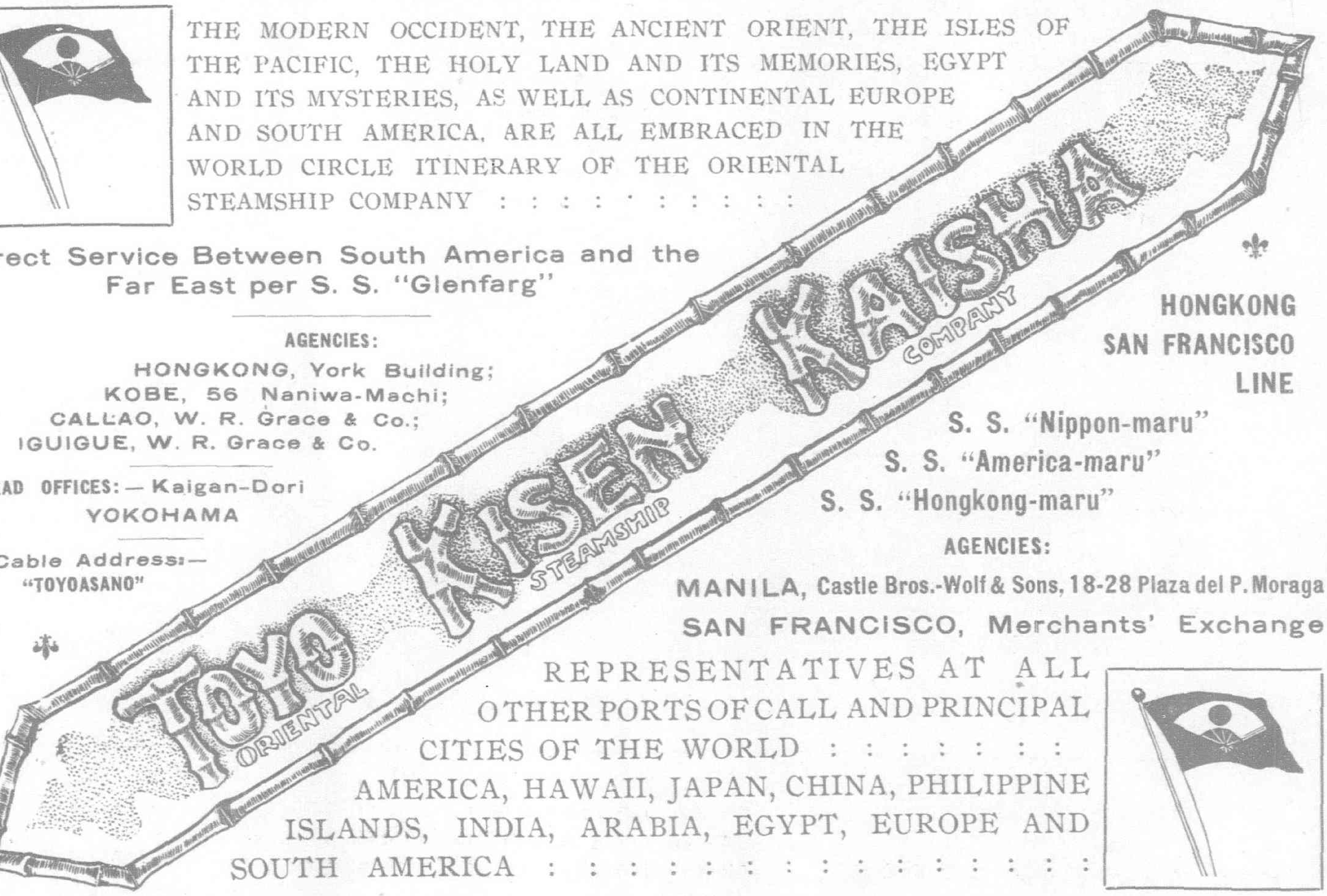

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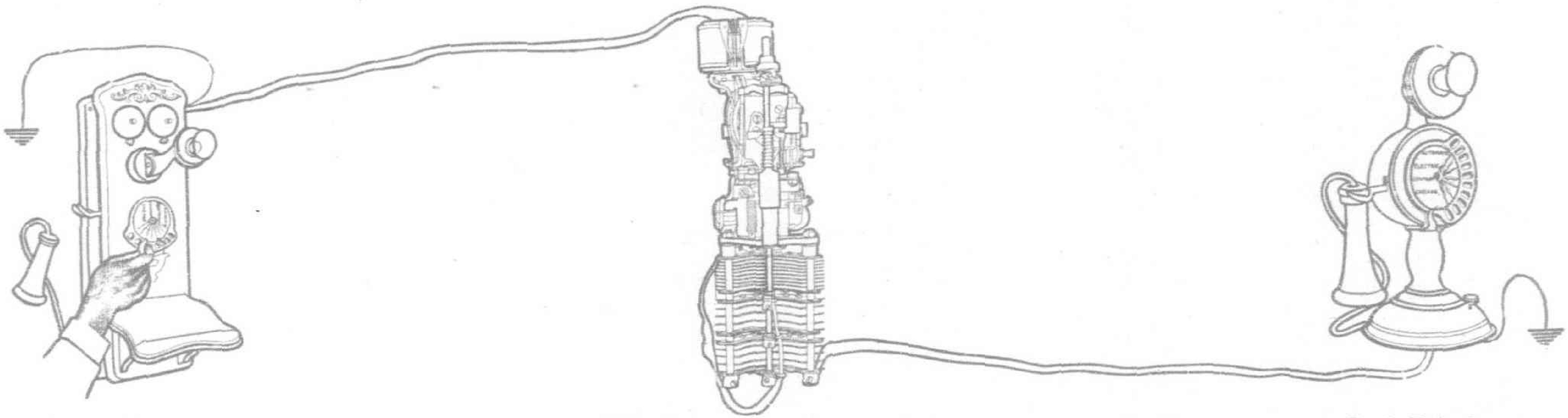

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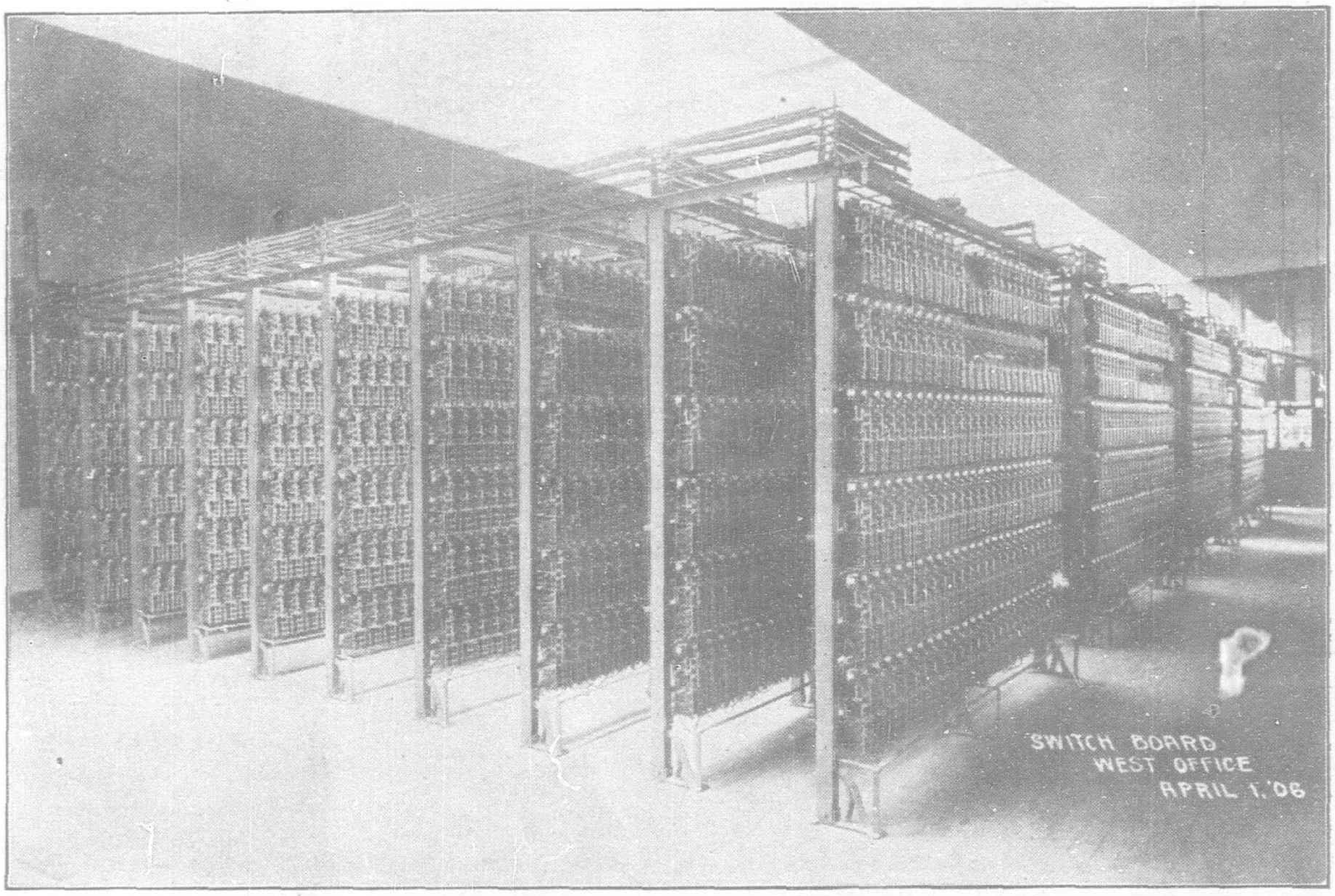

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OFFICIAL

U. S. Engineer Office, Fort Santiago, Manila, P. I., March 22, 1907.

Sealed proposals for one sea-going tug 100 to 125 feet long will be received at this office until 10 o'clock a. m., April 12, 1907, and then publicly opened. Information furnished on application.

SPECIFICATIONS

1. The tug is for general service in connection with work in this vicinity under direction of this office. The service will consist in carrying a few day passengers, and limited amounts of freight and provision supplies on deck, and in towing and handling freight barges. It is estimated that a vessel about 100 to 125 feet long, breadth about 20 feet, draught not over 9 feet, with corresponding steam power, will be adapted to the purpose, but vessels having considerable variations from these general dimensions may be considered if otherwise adapted to the requirements.

2. The vessel must be in first class condition, thoroughly sea-worthy, and provided with all furnishings, outfit, and appliances for safe and efficient service as above in Manila Bay and Harbor, the Pasig River, and for short trips outside in the China sea.

3. Bidders are requested to submit as complete descriptions as practicable of vessels offered, including engine and boiler dimensions, material of hull, when, where and by whom originally built, and a complete list of fittings and furnishings, with drawings and photographs if possible.

4. Before accepting any bid the bidder will be requested to afford proper facilities for thorough examination of all parts of hull and machinery, including opening up boiler and engine, and docking the vessel for an examination of the bottom. He will also be expected to give the boat trial runs under steam with the purchasing officer or his representative on board, of such duration and under such conditions as will thoroughly demonstrate her capacity and adaptability to the service required. All expense of such examination and trial must be borne by the bidder.

5. Bids can be considered only from actual owners or authorized agents, and evidence of ownership or authority to bid will be called for before considering a bid, if deemed advisable by the purchasing officer.

6. It is desired if practicable to procure a tug in first class order and completely fitted out ready for immediate service. If a vessel is offered that requires repairs or alterations or additional appliances or outfit of any kind to make her ready, the price should include making such repairs, etc., and completing outfit and these will be clearly specified by the bidder with statement of time he would require to deliver the vessel in all respect ready for service.

7. Delivery is to be made at Manila Harbor.

8. The right is reserved to consider only such bids as may contemplate a vessel adapted for this service in the judgment of the purchasing officer, and the right to reject any or all bids is distinctly reserved.

9. Bidders are requested to state the lowest net cash price in United States money, at which vessel complete and delivered as above is offered.

Proposals should be signed by the bidder, enclosed in sealed envelope, addressed to the undersigned, and marked on the outside of the envelope "Proposal for tug, to be opened April 12, 1907."

John Millis,
Major, Corps of Engineers

U. S. Engineer Office, Fort Santiago, Manila, P. I., March 22, 1907.

Sealed proposals for two decked barges will be received at this office until 10 o'clock a. m., April 2, 1907, and then publicly opened. Information furnished on application.

GENERAL SPECIFICATIONS

1. No proposal will be considered unless accompanied by a guaranty, which should be in manner and form as directed. At the option of bidders certified checks for the amount of the guaranty required may be furnished in place of the guaranty.

2. All bids and guaranties must be made in duplicate upon printed forms to be obtained at this office.

4. Each guarantor will justify in the sum of One thousand dollars ($1,000.00). The liability of the guarantors and bidder is determined by the act of March 3, 1883, 22 Statutes, 487, Chap. 120, and is expressed in the guaranty attached to the bid.

4. The bidder to whom award is made will be required to enter into written contract with the United States, with good and approved security, in an amount of One thousand dollars ($1,000.00) within ten (10) days after being notified of the acceptance of his proposal. The contract which the bidder and guarantors promise to enter into shall be, in its general provisions, in the form adopted and in general use by the Engineer Department of the Army, blank forms of which can be inspected at this office, and will be furnished, if desired, to parties proposing to put in bids. Parties making bids are to be understood as accepting the terms and conditions contained in such form of contract.

5. The proposals and guaranties must be placed in a sealed envelope marked "Proposals for Barges, to be opened April 2, 1907," and inclosed in another sealed envelope addressed to Major John Millis, Fort Santiago, Manila, P. I., but otherwise unmarked. It is suggested that the inner envelope be sealed with sealing wax.

6. Whenever the term "Engineer" is used in the specifications it is understood to refer to the officer of the Corps of Engineers, U. S. Army, in charge of the work. He will be represented on the work by as many assistants as may be necessary. Whenever the term "contractor" is used it is understood to refer to the second party to the contract. Subcontractors, as such, will not be recognized.

7. It is understood and agreed that the quantities given in these specifications are approximate only, and that no claim shall be made against the United States on account of any excess or deficiency, absolute or relative, in the same. No allowance will be made for the failure of a bidder or of the contractor to estimate correctly the difficulties attending the execution of the work.

8. The contractor will not be allowed to take advantage of any error or omission in these specifications, as full instructions will always be given should such error or omission be discovered.

9. It is understood and agreed that the contractor assumes full responsibility for the safety of his employees, plant, and materials, and for any damage or injury done by or to them from any source or cause.

10. In the prosecution of the work herein specified, the employment of persons undergoing sentences of imprisonment at hard labor which have been imposed by courts of the several States, Territories, or municipalities having criminal jurisdiction is prohibited.

11. The contractor will be required to discharge any employee who, in the opinion of the Engineer, is objectionable or incompetent. Such discharge shall not be made the basis of any claim for compensation or damages against the United States or any of its officers or agents.

12. The contractor must at all times either be personally present upon the work or be represented thereon by a responsible agent, who shall be clothed with full authority to act for him in all cases and to carry out any instructions relative to the work which may be given by the Engineer, either personally or through an authorized representative.

13. No work shall be done on Sundays or legal national holidays except in cases of emergency, and then only with the consent of the Engineer; nor shall any work be done at night unless authorized in writing by the Engineer.

14. The time allowed in these specifications for the completion of the contract to be entered into is considered sufficient for such completion by a contractor having the necessary plant, capital, and experience, unless extraordinary and unforeseeable conditions supervene.

15. Payments will be made for each barge upon its delivery and acceptance, reserving 10% from payment for first barge till final completion, delivery and acceptance of the second barge.

GENERAL INSTRUCTIONS FOR BIDDERS

1. The guaranty attached to the bid and the bond to the contract must be signed by an authorized surety company, or by two responsible guarantors or sureties, to be certified as good and sufficient guarantors or sureties by a judge or clerk of a United States court, United States district attorney United States commissioner, or judge or clerk of a State court of record, with seal of said court attached.

2. A firm, as such, will not be accepted as a guarantor or surety nor a partner for a copartner or firm of which he is a member. Stockholders who are not officers of a corporation may be accepted as guarantors or sureties for such corporation. Guarantors and sureties, if individuals, must be citizens of the United States, except that sureties to bonds executed in any foreign country, or in the Philippine Islands, Porto Rico, or Hawaii, for the performance of contracts entered into in those places, need not be citizens of the United States.

3. When the principal, a guarantor, or a surety is an individual, his signature to a guaranty or bond shall have affixed to it an adhesive seal. Corporate seals will be affixed by corporations, whether principals or sureties. All signatures to proposals, guaranties, contracts, and bonds should be written out in full, and each signature to guaranties, contracts, and bonds should be attested by at least one witness, and, when practicable, by a separate witness to each signature.

4. The guarantors and sureties, if individuals, are to make and subscribe affidavits of justification on the guaranty and bond. Each guarantor must justify in the amount required by the specifications. The sureties, if individuals, must justify in amounts which shall aggregate double the amount of the penal sum named in the bond.

5. All blank spaces in the proposal and guaranty must be filled in.

6. No change shall be made in the phraseology of the proposal, or addition to the items mentioned therein. Any conditions, limitations, or provisos attached to the proposals may render them informal and cause their rejection.

7. A proposal by a person who affixes to his signature the word "president," "secretary," "agent," or other designation, without disclosing his principal, is the proposal of the individual. That by a corporation should be signed with name of the corporation, followed by the signature of the president, secretary, or other person authorized to bind it in the matter, who should file evidence of his authority to do so. That by a firm should be signed with the firm name, either by a member thereof or by its agent, giving the names of all members of the firm. Anyone signing the proposal as the agent of another or others must file with it legal evidence of his authority to do so.

8. Proposals must be prepared without assistance from any person employed in or belonging to the military service of the United States or employed under the Engineer Department.

9. Alterations by erasure or interlineation must be explained or noted in the proposals over the signature of the bidder.

10. If a bidder wishes to withdraw his proposals, he may do so before the time fixed for the opening, without prejudice to himself, by communicating his purpose in writing to the officer who holds it, and, when reached, it shall be handed to him or his authorized agent, unread.

11. The advertisement and the specification attached to the form of proposals, all of which can be obtained on application by mail or in person, must be considered as comprising a part of the proposal. The advertisement and specifications will also be attached to, and form a part of, the contract.

12. All prices must be writen as well as expressed in figures.

13. The place of residence of every bidder, and post-office address, with county and State, must be given after his signature.

14. The bidder to whom the contract is awarded shall, within ten days from the award, furnish the office with the post-office address to which communications should be sent.

15. Bidders, or their authorized agents, are expected to examine the maps and drawings pertaining to the work, which are open to their inspection, to visit the locality of the work and to make their own estimates of the facilities and difficulties attending the execution of the proposed contract, including local conditions, uncertainty of weather, and all other contingencies.

16. The United States reserves the right to reject any and all bids and to waive any informality in the bids received; also to disregard the bid of any failing bidder or contractor known as such to the Engineer Department, or any bid which is palpably unbalanced or obviously below what the work can be done for, or the bid of any bidder who shall fail to produce, when called upon to do so, evidence satisfactory to the engineer officer in charge of the said bidder's ability to do the contemplated work within the required time, including his control of the necessary means and equipment. The failure of a bidder to make satisfactory progress or to complete on time similar work under previous contracts with the United States will be duly considered in canvassing bids and may be a valid cause for the rejection of his proposal. Reasonable grounds for supposing that any bidder is interested in more than one bid for the same item will cause the rejection of all bids in which he is interested.

17. Bidders are invited to be present at the opening of the bids.

18. No bids received after the time set for opening of proposal will be considered.

19. No bidder will be informed, directly or indirectly, of the name of any person intending to bid or not to bid, or to whom information in respect to proposals may have been given.

20. The importation of foreigners and aliens, under contract or agreement, to perform labor in the United States or Territories or the District of Columbia is prohibited by law.

21. Preference will be given to articles or materials of domestic production, conditions of quality and price being equal, including in the price of foreign articles the duty thereon.

U. S. Engineer Office, Fort Santiago, Manila, P. I., March 22, 1907.

Sealed proposals for about 50,000 barrels Portland cement, more or less, will be received at this office until 10 o'clock a. m. April 22, 1907, and then publicly opened. Information furnished on application.

GENERAL SPECIFICATIONS

1. No proposal will be considered unless accompanied by a guaranty, which should be in manner and form as directed. At the option of bidders certified checks for the amount of the guaranty required may be furnished in place of the guaranty.

2. All bids and guaranties must be made in duplicate upon printed forms to be obtained at this office.

3. Each guarantor will justify in the sum of ten thousand (10,000) dollars. The liability of the guarantors and bidder is determined by the act of March 3, 1883, 22 Statutes, 487, Chap. 120, and is expressed in the guaranty attached to the bid.

4. The bidder to whom award is made will be required to enter into written contract with the United States, with good and approved security, in an amount of twenty thousand (20,000) dollars within twenty (20) days after being notified of the acceptance of his proposal. The contract which the bidder and guarantors promise to enter into shall be, in its general provisions, in the form adopted and in general use by the Engineer Department of the Army, blank forms of which can be inspected at this office, and will be furnished, if desired, to parties proposing to put in bids. Parties making bids are to be understood as accepting the terms and conditions contained in such form of contract.

5. The proposals and guaranties must be placed in a sealed envelope marked "Proposals for Portland Cement, to be opened April 22, 1907," and inclosed in another sealed envelope addressed to Major John Millis, Fort Santiago, Manila, P. I., but otherwise unmarked. It is suggested that the inner envelope be sealed with sealing wax.

16. Payment will be made for each lot of 3,000 barrels or more of cement upon acceptance, reserving 15% of the amount due until the acceptance of a succeeding amount of not less than 3,000 barrels, except in case of the final lot delivered under the contract. For the final lot delivered full payment will be due upon acceptance, subject to all other provisions of the contract.

17. The cement shall be what is ordinarily known as regular Portland cement, of some well known brand of high reputation.

20. The cement shall be put up in tight, strongly made and sound wooden barrels capable of standing rough handling. The barrels are to be well lined with strong and reasonably moisture-proof paper, so as to be well adapted for storage for a considerable period in this climate. Each package shall be plainly labeled with the name of the brand and of the manufacturer. It is suggested that bidders be prepared to show sample barrels of the cement it is proposed to furnish if practicable, so that preliminary tests may be made of the cement itself, and also to establish whether the form of package and method of packing are satisfactory.

22. The average net weight of cement per barrel as paid for shall not be less than 375 pounds. If the net weight as determined by the test weighings is found to be below 375 pounds per barrel, the cement may be rejected, or, at the option of the Engineer, it may be accepted and paid for at contract price at the rate of 375 lbs. net per barrel, or the contractor may be required to supply, free of cost to the United States, an additional amount of cement equal to the shortage on any particular lot. No additional payment above contract rate per barrel will be made in case of cement weighing more than 375 lbs. net per barrel.

24. The cement must not show marked indications of free lime in excess. It must not contain more than 1.75% of anhydrous sulphuric acid (SO_3) and must not contain more than 4% of magnesia (MgO).

36. The cement is to be used partly at Subic Bay and partly at Manila Bay, Island of Luzon. The relative proportions for the two places can not be definitely stated at present, but probably the larger part will be required at Subic Bay.

37. For either place delivery is to be made at Government wharf near works in tight and seaworthy barges or lorchas, provided with proper mooring lines and covering to protect the cement against damage by rain, leakage or spray.

38. Reasonable assistance in moving and caring for the barges after delivery, while unloading and until taken away, will be given by the Government, but no further responsibility for the barges can be assumed by the Government, and the contractor must provide usual crew to look out for them.

39. Bidders are requested to state prices separately for delivery as follows:

a. In barges or lorchas as specified, at wharf near works, Subic Bay.

b. In barges or lorchas as specified, at wharf near works, Manila Bay.

40. All barges delivered are to be discharged by the Government without undue delay and as rapidly as practicable after receipt.

41. The first lot of cement delivered to be approximately 8,000 barrels, and this lot is to be delivered within one hundred days from date of notice to the contractor that his bid is accepted. This amount may however be received in smaller lots at earlier dates of delivery, provided the total delivery of 8000 barrels is completed within the 100 days. Thereafter the cement to be delivered as nearly as practicable as called for, which will be in lots of about 8000 barrels each two months, or, with the concurrence of the contractor, in smaller or larger lots at correspondingly smaller or larger intervals between deliveries, until the contract is terminated.

42. The right is reserved to increase or decrease the total amount taken by thirty per cent of the 50,000 barrels specified, and in any case no cement is to be called for under this contract at a later date than to reasonably permit final delivery and completion of the contract by June 30, 1908. After such final delivery the contract is to be regarded as terminated. Consideration will be given to bids for a less amount of cement than that specified, if any bidder desires to submit such a bid, but other things being equal precedence will be given to regular bids for the amount specified.

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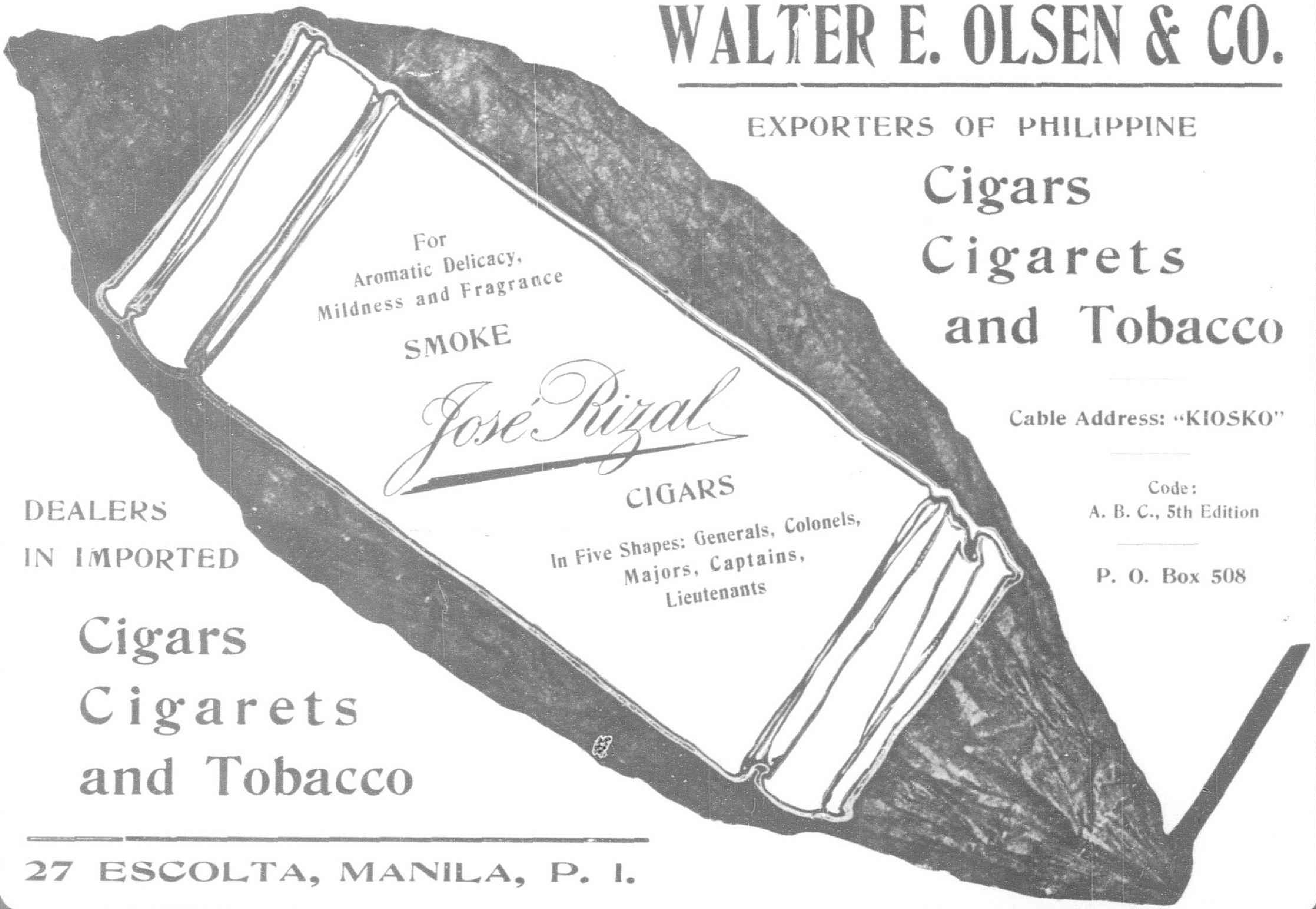

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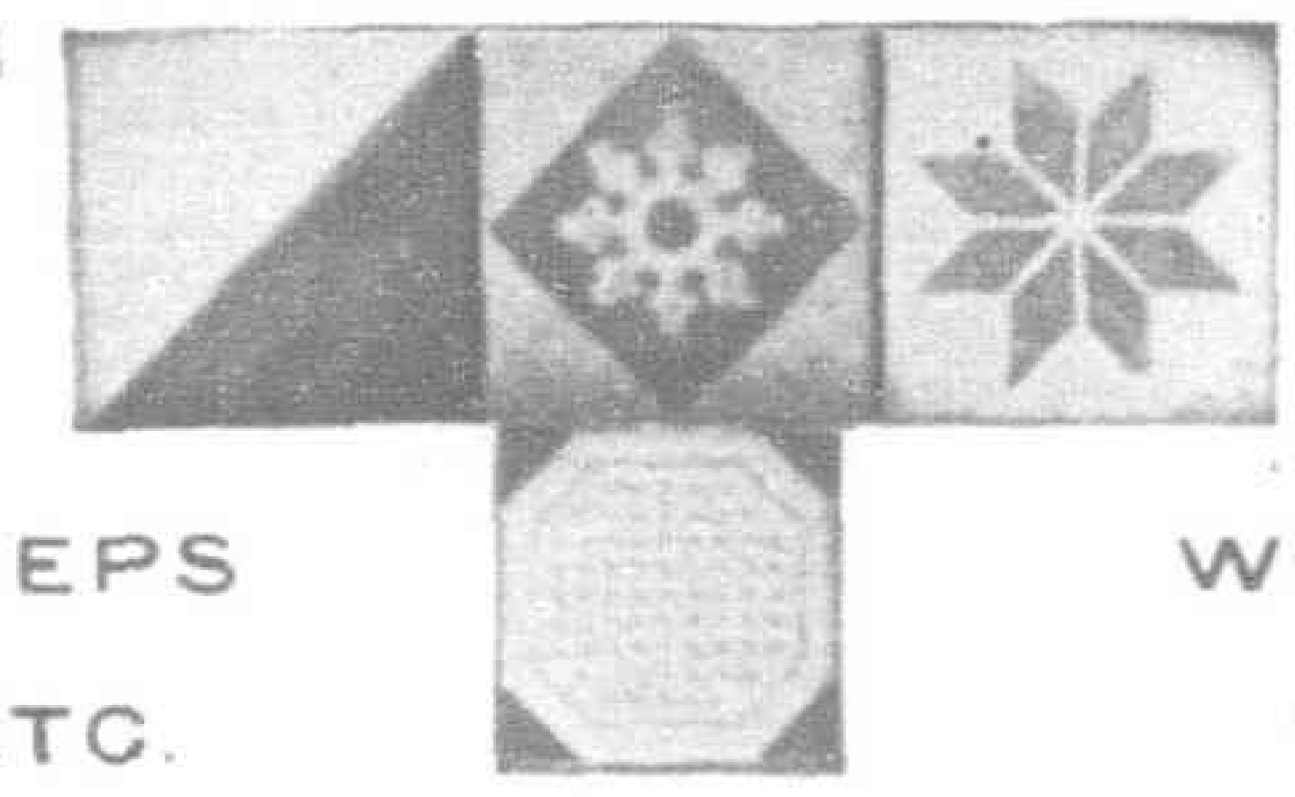

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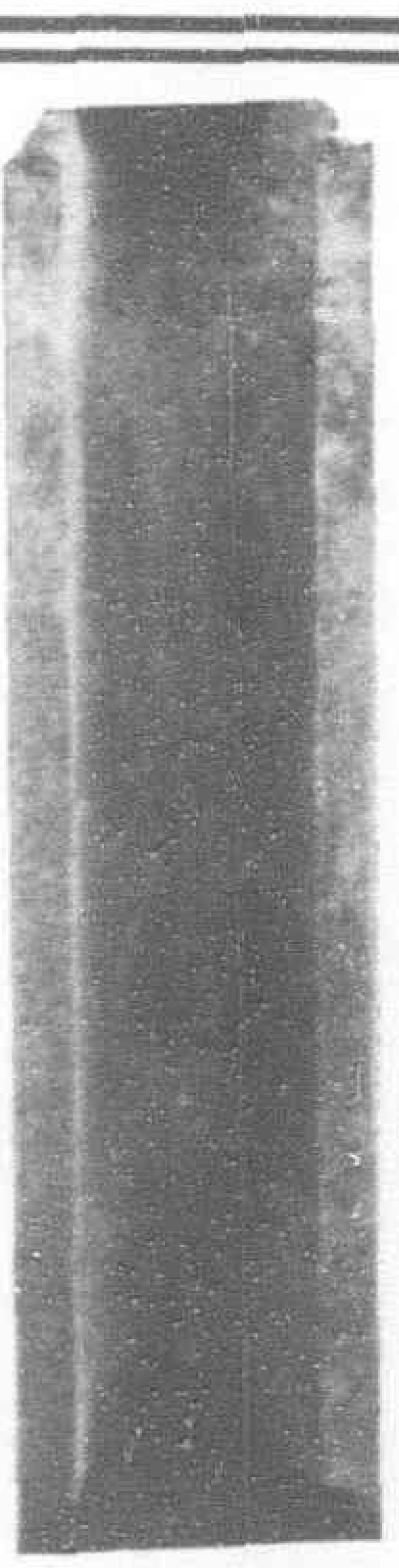

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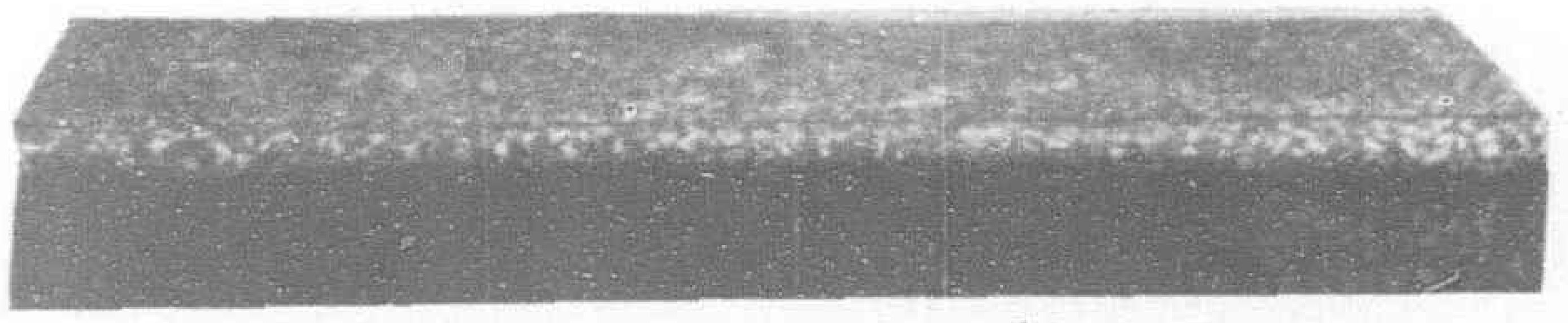

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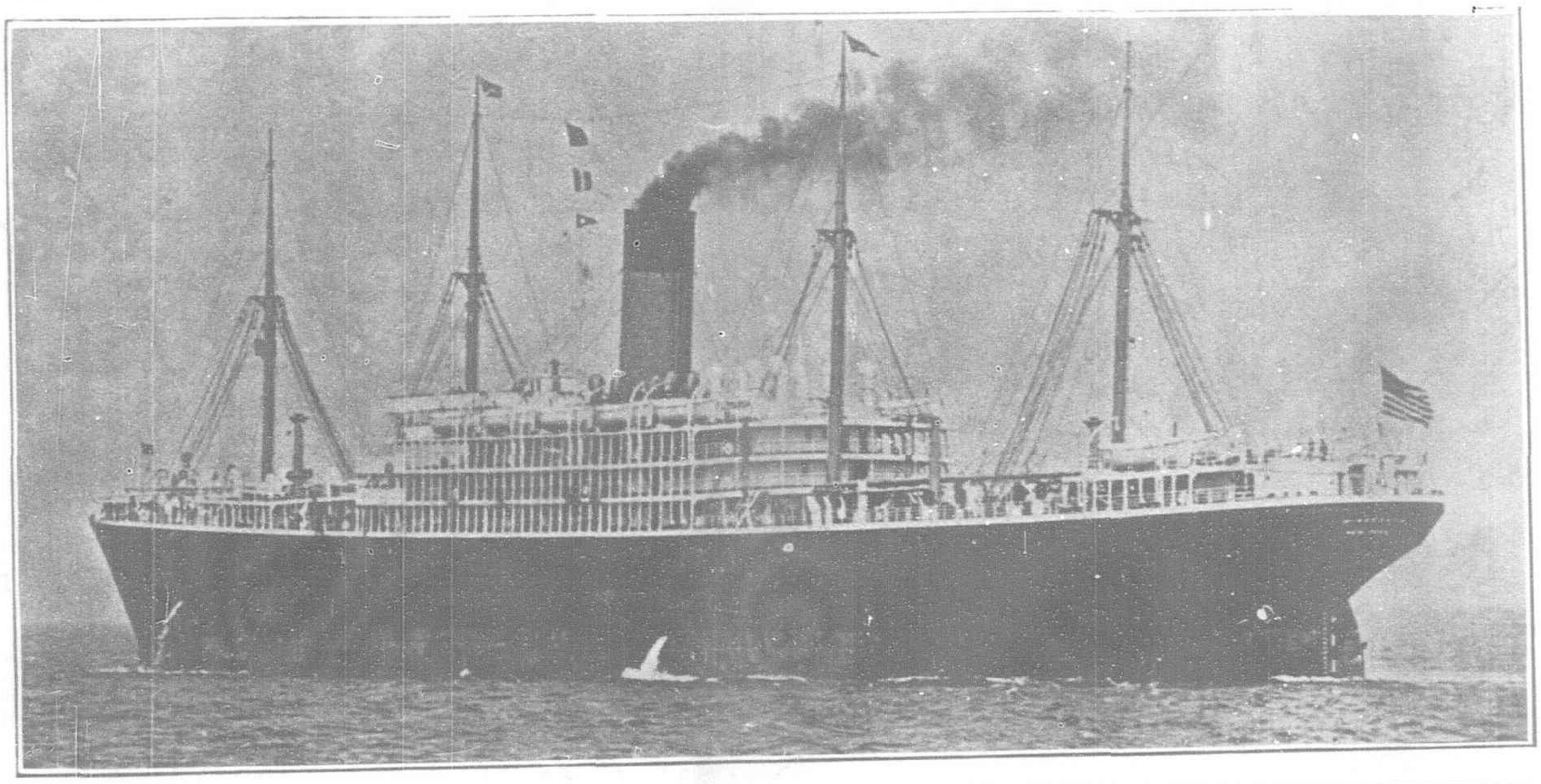

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